UMALUSI

COUNCIL FOR QUALITY ASSURANCE IN GENERAL AND FURTHER EDUCATION AND TRAINING

Exemplar Book on Effective Questioning

Information Technology

Compiled by the Statistical Information and Research (SIR) Unit

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PREFACE

The National Senior Certificate (NSC) examinations are set and moderated in part using tools which specify the types of cognitive demand and the content deemed appropriate for Information Technology at Grade 12 level. Until recently, the level of cognitive demand made by a question was considered to be the main determinant of the overall level of cognitive challenge of an examination question.

However, during various examination evaluation projects conducted by Umalusi from 2008-2012, evaluators found the need to develop more complex tools to distinguish between questions which were categorised at the same cognitive demand level, but which were not of comparable degrees of difficulty. For many subjects, for each type of cognitive demand a three-level degree of difficulty designation, *easy, moderate and difficult* was developed. Evaluators first decided on the type of cognitive process required to answer a particular examination question, and then decided on the degree of difficulty, *as an attribute of the type of cognitive demand*, of that examination question.

Whilst this practice offered wider options in terms of *easy, moderate* and *difficult* levels of difficulty for each type of cognitive demand overcame some limitations of a one-dimensional cognitive demand taxonomy, other constraints emerged. Bloom's Taxonomy of Educational Objectives (BTEO) (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) and the Revised Bloom's Taxonomy are based on the assumption that a cumulative hierarchy exists between the different categories of cognitive demand (Bloom et al., 1956; Bloom, Hastings & Madaus, 1971). The practice of 'levels of difficulty' did not necessarily correspond to a hierarchical model of increasing complexity of cognitive demand. A key problem with using the level of difficulty as an attribute of the type of cognitive demand of examination questions is that, questions recognised at a higher level of cognitive demand are not necessarily categorised as more difficult than other questions categorised at lower levels of cognitive demand. For example, during analyses a basic recognition or

recall question could be considered more difficult than an easy evaluation question.

Research further revealed that evaluators often struggled to agree on the classification of questions at so many different levels. The finer categorization for each level of cognitive demand and the process of trying to match questions to pre-set definitions of levels of difficulty made the process of making judgments about cognitive challenge overly procedural. The complex two-dimensional multi-level model also made findings about the cognitive challenge of an examination very difficult for Umalusi Assessment Standards Committee (ASC) to interpret.

In an Umalusi Report, *Developing a Framework for Assessing and Comparing the Cognitive Challenge of Home Language Examinations* (Umalusi, 2012), it was recommended that the type and level of cognitive demand of a question and the level of a question's difficulty should be analysed separately. Further, it was argued that the ability to assess cognitive challenge lay in experts' abilities to recognise subtle interactions and make complicated connections that involved the use of multiple criteria simultaneously. However, the tacit nature of such judgments can make it difficult to generate a common understanding of what constitutes criteria for evaluating the cognitive challenge of examination questions, despite descriptions given in the policy documents of each subject.

The report also suggested that the Umalusi external moderators and evaluators be provided with a framework for thinking about question difficulty which would help them identify where the main sources of difficulty or ease in questions might reside. Such a framework should provide a common language for evaluators and moderators to discuss and justify decisions about question difficulty. It should also be used for building the capacity of novice or less experienced moderators and evaluators to exercise the necessary expert judgments by making them more aware of key aspects to consider in making such judgments.

The revised Umalusi examination moderation and evaluation instruments for each subject draw on research and literature reviews, together with the knowledge gained through the subject workshops. At these workshops, the proposed revisions were discussed with different subject specialists to attain a common understanding of the concepts, tools and framework used; and to test whether the framework developed for thinking about question difficulty 'works' for different content subjects. Using the same framework to think about question difficulty across subjects will allow for greater comparability of standards across subjects and projects.

An important change that has been made to the revised examination evaluation instrument is that the analysis of *the type of cognitive demand* of a question and analysis of *the level of difficulty* of each question are now treated as two separate judgments involving two different processes. Accordingly, the revised examination evaluation instrument now includes assessment of difficulty *as well as* cognitive demand.

LIST OF ABBREVIATIONS

Abbreviation	Full name
ASC	Assessment Standards Committee
BTEO	Bloom's Taxonomy of Educational Objectives
CAPS	Curriculum Assessment Policy Statement
DBE	Department of Basic Education
FET	Further Education and Training
IEB	Independent Examinations Board
NSC	National Senior Certificate
NQF	National Qualifications Framework
QAA	Quality Assurance of Assessment
QCC	Qualifications, Curriculum and Certification
SIR	Statistical Information and Research

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ACKNOWLEDGEMENTS

This Information Technology exemplar book is informed by Umalusi Research Reports of previous years, especially the report by Reeves (Umalusi, 2012) titled '*Developing a framework for assessing and comparing the cognitive challenge of Home Language examinations*'.

In addition, Information Technology subject experts and practitioners are acknowledged for their contribution to the content of this exemplar book. Included in this group are: Umalusi External Moderators and Maintaining Standards Subject Teams and Team Leaders; together with the South African Comprehensive Assessment Institute and the Independent Examinations Board (IEB) Examiners and Internal Moderators.

We also acknowledge the contributions of the members of the Umalusi Quality Assurance of Assessment (QAA); Qualifications, Curriculum and Certification (QCC) and Statistical Information and Research (SIR) Units. We specifically acknowledge the contribution made by the individuals listed below:

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This exemplar book was prepared by Prof. Desmond Govender.

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1. INTRODUCTION

The rules of assessment are essentially the same for all types of learning because, to learn is to acquire knowledge or skills, while to assess is to identify the level of knowledge or skill that has been acquired (Fiddler, Marienau & Whitaker, 2006). Nevertheless, the field of assessment in South Africa and elsewhere in the world is fraught with contestation. A review of the research literature on assessment indicates difficulties, misunderstanding and confusion in how terms describing educational measurement concepts, and the relationships between them, are used (Frisbie, 2005).

Umalusi believes that if all role players involved in examination processes can achieve a common understanding of key terms, concepts and processes involved in setting, moderating and evaluating examination papers, much unhappiness can be avoided. This exemplar book presents a particular set of guidelines for both novice and experienced Information Technology national examiners, internal and external moderators, and evaluators to use in the setting, moderation and evaluation of examinations at the National Senior Certificate (NSC) level.

The remainder of the exemplar book is organised as follows: First, the context in which the exemplar book was developed is described (Part 2), followed by a statement of its purpose (Part 3). Brief summaries of the roles of moderation and evaluation (Part 4) and cognitive demand (Part 5) an assessment. Examination questions selected from the NSC Information Technology examinations of assessment bodies, the Department of Basic Education (DBE), and/or the Independent Examinations Board (IEB) are used to illustrate how to identify different levels of cognitive demand as required by the Curriculum and Assessment Policy Statement (CAPS) Information Technology document (Part 6). Part 7 explains the protocols for identifying different levels of difficulty within a question paper. Application of the Umalusi framework for determining

difficulty described in Part 7 is illustrated, with reasons, by another set of questions from a range of Information Technology examinations (Part 8). Concluding remarks complete the exemplar book (Part 9).

2. CONTEXT

Umalusi has the responsibility to quality assure qualifications, curricula and assessments of National Qualification Framework (NQF) Levels 1 - 5. This is a legal mandate assigned by the *General and Further Education and Training Act (Act 58 of 2001)* and the *National Qualification Framework Act (Act 67 of 2008)*. To operationalize its mandate, Umalusi, amongst other things, conducts research and uses the findings of this research to enhance the quality and standards of curricula and assessments.

Since 2003, Umalusi has conducted several research studies that have investigated examination standards. For example, Umalusi conducted research on the NSC examinations, commonly known as 'Matriculation' or Grade 12, in order to gain an understanding of the standards of the new examinations (first introduced in 2008) relative to those of the previous NATED 550 Senior Certificate examinations (Umalusi, 2009a, 2009b). Research undertaken by Umalusi has assisted the organisation to arrive at a more informed understanding of what is meant by assessing the cognitive challenge of the examinations and of the processes necessary for determining whether the degree of cognitive challenge of examinations is comparable within a subject, across subjects and between years.

Research undertaken by Umalusi has revealed that different groups of examiners, moderators and evaluators do not always interpret cognitive demand in the same way, posing difficulties when comparisons of cognitive challenge were required. The research across all subjects also showed that

using the type and level of cognitive demand of a question *only* as measure for judging the cognitive challenge of a question is problematic because cognitive demand levels on their own do not necessarily distinguish between degrees of difficulty of questions.

The new Umalusi framework for thinking about question difficulty described in this exemplar book is intended to support all key role players in making complex decisions about what makes a particular question challenging for Grade 12 examination candidates.

3. THE PURPOSE OF THE EXEMPLAR BOOK

The overall goal of this exemplar book is to ensure the consistency of standards of examinations across the years in the Further Education and Training (FET) sub-sector and Grade 12, in particular. The specific purpose is to build a shared understanding among teachers, examiners, moderators, evaluators, and other stakeholders, of methods used for determining the type and level of cognitive demand as well as the level of difficulty of examination questions.

Ultimately, the common understanding that this exemplar book seeks to foster is based on the premise that the process of determining the type and level of cognitive demand of questions and that of determining the level of difficulty of examination questions are two separate judgements involving two different processes, both necessary for evaluating the cognitive challenge of examinations. This distinction between cognitive demand and difficulty posed by questions needs to be made in the setting, moderation, evaluation and comparison of Information Technology examination papers.

The exemplar book includes an explanation of the new Umalusi framework which is intended to provide all role-players in the setting of Information Technology examinations with a common language for thinking and talking

about question difficulty. The reader of the exemplar book is taken through the process of evaluating examination questions; first in relation to determining the type and level of cognitive demand made by a question, and then in terms of assessing the level of difficulty of a question. This is done by providing examples of a range of questions which make different types of cognitive demands on candidates, and examples of questions at different levels of difficulty.

Each question is accompanied by an explanation of the reasoning behind why it was judged as being of a particular level of cognitive demand or difficulty, and the reasoning behind the judgements made is explained. The examples of examination questions provided were sourced by Information Technology evaluators from previous DBE and the IEB Information Technology question papers, pre- and post- the implementation of CAPS during various Umalusi workshops.

This exemplar book is an official document. The process of revising the Umalusi examination evaluation instrument and of developing a framework for thinking about question difficulty for both moderation and evaluation purposes has been a consultative one, with the DBE and the IEB assessment bodies. The new framework for thinking about question difficulty is to be used by Umalusi in the moderation and evaluation of Grade 12 Information Technology examinations, and by all the assessment bodies in the setting of the question papers, in conjunction with the CAPS documents.

4. MODERATION AND EVALUATION OF ASSESSMENT

A fundamental requirement, ethically and legally, is that assessments are fair, reliable and valid (American Educational Research Association [AERA], American Psychological Association [APA] and National Council on Measurement in Education [NCME], 1999). Moderation is one of several quality

assurance assessment processes aimed at ensuring that an assessment is fair, reliable and valid (Downing & Haladyna, 2006). Ideally, moderation should be done at all levels of an education system, including the school, district, provincial and national level in all subjects.

The task of Umalusi examination **moderators** is to ensure that the quality and standards of a particular examination are maintained each year. Part of this task is for moderators to alert examiners to details of questions, material and/or any technical aspects in examination question papers that are deemed to be inadequate or problematic and that therefore, challenge the validity of that examination. In order to do this, moderators need to pay attention to a number of issues as they moderate a question paper – these are briefly described below.

Moderation of the technical aspects of examination papers includes checking correct question and/or section numbering, and ensuring that visual texts and/or resource material included in the papers are clear and legible. The clarity of instructions given to candidates, the wording of questions, the appropriateness of the level of language used, and the correct use of terminology need to be interrogated. Moderators are expected to detect question predictability, for example, when the same questions regularly appear in different examinations, and bias in examination papers. The adequacy and accuracy of the marking memorandum (marking guidelines) need to be checked to ensure that they reflect and correspond with the requirements of each question asked in the examination paper being moderated.

In addition, the task of moderators is to check that papers adhere to the overall examination requirements as set out by the relevant assessment body with regard to the format and structure (including the length, type of texts or reading selections prescribed) of the examination. This includes assessing compliance with assessment requirements with regard to ensuring that the

content is examined at an appropriate level and in the relative proportions (weightings) of content and/or skills areas required by the assessment body.

The role of Umalusi examination **evaluators** is to perform analysis of examination papers after they have been set and moderated and approved by the Umalusi moderators. This type of analysis entails applying additional expert judgments to evaluate the quality and standard of finalised examination papers before they are written by candidates in a specific year. However, the overall aim of this evaluation is to judge the comparability of an examination against the previous years' examination papers to ensure that consistent standards are being maintained over the years.

The results of the evaluators' analyses, and moderators' experiences provide the Umalusi Assessment Standards Committee (ASC) with valuable information which is used in the process of statistical moderation of each year's examination results. Therefore, this information forms an important component of essential qualitative data informing the ASC's final decisions in the standardisation of the examinations.

In order for the standardisation process to work effectively, efficiently and fairly, it is important that examiners, moderators and evaluators have a shared understanding of how the standard of an examination paper is assessed, and of the frameworks and main instruments that are used in this process.

5. COGNITIVE DEMANDS IN ASSESSMENT

The *Standards for educational and psychological testing* (AERA, APA, & NCME, 1999) require evidence to support interpretations of test scores with respect to cognitive processes. Therefore, valid, fair and reliable examinations require that the levels of cognitive demand required by examination questions are appropriate and varied (Downing & Haladyna, 2006). Examination papers

should not be dominated by questions that require reproduction of basic information, or replication of basic procedures, and under-represent questions invoking higher level cognitive demands.

Accordingly, the Grade 12 CAPS NSC subject examination specifications state that examination papers should be set in such a way that they reflect proportions of marks for questions at various level of cognitive demand. NSC examination papers are expected to comply with the specified cognitive demand levels and weightings. NSC examiners have to set and NSC internal moderators have to moderate examination papers as reflecting the proportions of marks for questions at different levels of cognitive demand as specified in the documents. Umalusi's external moderators and evaluators are similarly tasked with confirming compliance of the examinations with the CAPS cognitive demand levels and weightings, and Umalusi's revised examination evaluation instruments continue to reflect this requirement.

Despite that, subject experts, examiners, moderators and evaluators are familiar with the levels and explanations of the types of cognitive demand shown in the CAPS documents, Umalusi researchers have noted that individuals do not always interpret and classify the categories of cognitive demand provided in the CAPS the same way. In order to facilitate a common interpretation and classification of the cognitive demands made by questions, the next section of this exemplar book provides a clarification of each cognitive demand level for Information Technology followed by illustrative examples of examination questions that have been classified at that level of cognitive demand.

6. EXPLANATIONS AND EXAMPLES OF QUESTIONS ASSESSED AT THE DIFFERENT COGNITIVE DEMAND LEVELS IN THE INFORMATION TECHNOLOGY TAXONOMY ACCORDING TO CAPS

The taxonomies of cognitive demand for each school subject in the CAPS documents are mostly based on the Revised Bloom's Taxonomy (Anderson and Krathwohl, 2001) but resemble the original Bloom's taxonomy in that categories of cognitive demand are arranged along a single continuum. Bloom's Taxonomy of Educational Objectives (BTEO) (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) and the Revised Bloom's Taxonomy imply that each more advanced or successive category of cognitive demand subsumes all categories below it. The CAPS Taxonomies of Cognitive Demand make a similar assumption (Crowe, 2012).

Note:
In classifying the type and level of cognitive demand, each question is classified at the highest level of cognitive process involved. Thus, although a particular question involves recall of knowledge, as well as comprehension and application, the question is classified as an 'analysis' question if that is the highest level of cognitive process involved. If evaluating' is the highest level of cognitive process involved, the question as a whole should be classified as an 'evaluation' question. On the other hand, if one of more sub-sections of the question and the marks allocated for each sub-section can stand independently, then the level of cognitive demand for each sub-section of the question should be analysed separately.

The CAPS documents for many subjects also give examples of descriptive verbs that can be associated with each of the levels of cognitive demand. However, it is important to note that such 'action verbs' can be associated with more than one cognitive level depending on the context of a question.

The Information Technology CAPS document states that Grade 12 NSC Information Technology examination papers should examine three levels of cognitive demand (Table 1).

TABLE 1: THE TAXONOMY OF COGNITIVE DEMAND LEVELS FOR THE INFORMATION TECHNOLOGY NSC EXAMINATIONS

	L1 **Lower Order**	**L2** **Middle Order**	**L3** **Higher Order**
Practical examination	**Routine procedures**	**Multi-step procedures/ Extensions**	**Problem-solving**
Theoretical examination	**Knowledge/ Remembering**	**Understanding/ Applying**	**Analysing/Evaluating/ Creating**

Source: CAPS (DBE, 2011a, p.51)

To facilitate reading of this section, each of the above cognitive demand levels in the Information Technology Taxonomy are explained, and the explanation is followed by at least **three** examples of questions from previous Information Technology NSC examinations classified at each of the levels of cognitive demand shown in Table 1 above. These examples were selected to represent the **best and clearest** examples of each level of cognitive demand that the Information Technology experts could find. The discussion below each example question explains the reasoning processes behind the classification of the question at that particular type of cognitive demand (Table 2 to Table 5).

Note:
Be mindful that analyses of *the level of cognitive process* of a question and *the level of difficulty* of each question are to be treated as two separate judgments involving two different processes. Therefore, whether the question is easy or difficult should not influence the categorisation of the question in terms of the type and level of cognitive demand. Questions should NOT be categorised as higher order evaluation/synthesis questions because they are difficult questions. Some questions involving the cognitive process of recall or recognition may be more difficult than other recall or recognition questions. Not all comprehension questions are easier than questions involving analysis or synthesis. Some comprehension questions may be very difficult, for example explanation of complex scientific processes. For these reasons, you need to categorise the level of difficulty of questions separately from identifying the type of cognitive process involved.

The following Tables will provide examples of questions that can be categorised according to cognitive levels. Please note that it may be easier to

classify examples of theory questions from IT Paper Two into these levels rather than programming examples from IT Paper One. Therefore, we have included mostly examples from the Theory IT Paper Two and one example each from IT Paper One. Please note that the programming examples are not easily classified into a particular level or a level of difficulty as explained later. Programming solutions can have aspects of all three cognitive levels and all four levels of difficulty. However, we have tried to classify our programming examples based on Routine procedures – Level 1, Multi-step procedures – Level Two and Problem Solving – Level Three. For levels of difficulty, we have tried to categorise according to the highest level of difficulty that may be present in a programming example.

Also, we are fully aware that the programming language used at schools now is Delphi. However, our practical examples were extracted from past year papers as early as 2012, and therefore includes aspects of Delphi and Java.

In order to answer the programming questions, data files are required. The data files for each of the questions cited in this document can be found at the Department of Basic Education's website:

http://www.education.gov.za/Examinations/PastExamPapers/tabid/351/Default.aspx

TABLE 2: EXAMPLES OF QUESTIONS AT LEVEL 1: (KNOWLEDGE/REMEMBERING)

Example 1:
Question 2.1.1(a): 2012, November Paper 2: Define the term *refresh rate*. (2)
Discussion: This question is classified as a 'knowledge' and 'remembering' question. This category of question entails locating, identifying or retrieving any kind of explicitly stated information, ideas, facts or details either in source material provided, or from memory of previously learned or read material, and recognition of the relevance of the information, ideas, facts or details in relation to the question. In this case, candidates have to recall the definition of 'refresh rate' which they should have learnt in class. They do not have to show

understanding of the concept but simply have to provide a learnt definition; a 'remembering' of basic knowledge task.

Memorandum/Marking guidelines

Refresh rate is the number of times/speed of how often, √ the screen must be refreshed or redrawn.√ **(2)**

Example 2:

Question 2.1.2(a) (i), 2012, November Paper 2:

What is *metadata?* (2)

Discussion:

In this case, candidates have to remember what they should have learnt in class about 'metadata'. They can simply provide a learnt definition and do not have to explain the concept. This information is basic knowledge which they must retrieve from memory.

Memorandum/Marking guidelines

Metadata is data√ about data√ (2)

Example 3:

Question 2.1.3 (b) (i), 2012, November Paper 2:

Explain what *virtual memory* is. (2)

Discussion:

The action verb 'explain' in this question suggests that answering the question may involve 'understanding'. However, this is not the case because candidates do not have to show that they understand 'virtual memory'; they need only state what virtual memory is. The question could as well have been phrased as: State what is meant by the term *virtual memory*. This question thus simply requires recall of knowledge learnt in class

Memorandum/Marking guidelines

The operating system uses secondary storage √ (hard drive) space as memory √ (temporary or simulated or additional RAM). (2)

Example 4: Practical Paper

Question 2.1.1: DBE, November 2016, IT Paper 1

Synopsis of scenario on which question is based:

Aqua Wonderland is a water theme park that provides entertainment, access to restaurants, shopping, water slides and many more activities. The administrators of Aqua Wonderland are currently working on different techniques and strategies to improve the popularity of the park.

Aqua Wonderland is hosting a special five-day educational programme at the aquarium. Schools can arrange with the administrators at the park to take learners on an excursion to the aquarium on any one of the specific days when the programme is hosted. When a school requests to visit the park on a specific date, the administrators will confirm

whether the school can attend, depending on the space available to accommodate the group of learners.

Delphi programmers	Java programmers
• Open the incomplete program in the **Question2** folder. • Open the incomplete object class **Excursion_U.pas**. • Enter your examination number as a comment in the first line of both files **Question2_U.pas** and **Excursion_U.pas**.	• Open the incomplete program in the **Question2** folder. • Open the incomplete object class **Excursion.java**. • Enter your examination number as a comment in the first line of both classes **Question2.java** and **Excursion.java**. .

Compile and execute the program. Currently, the program has no functionality. A hidden panel called **pnlAvailability** will not be visible when the program is executed and will be used in …

Example of user interface:

2.1 The given incomplete object class (**TExcursion/Excursion**) contains the declaration of four attributes and methods which describe an Excursion object.

The attributes for the **Excursion** object are as follows:

NAMES OF ATTRIBUTES		DESCRIPTION
Delphi	**Java**	
fSchoolName	schoolName	The name of the school
fVisitDate	visitDate	The date the school wants to visit the aquarium in the format YYYY-MM-DD
fGroupSize	groupSize	The number of learners in the group
fTourGuide	tourGuide	A Boolean attribute with the value of 'true' if the school requires a tour guide or 'false' if the school does not require a tour guide

Complete the code in the given Excursion object class (TExcursion/Excursion) as described in QUESTION 2.1.1 …

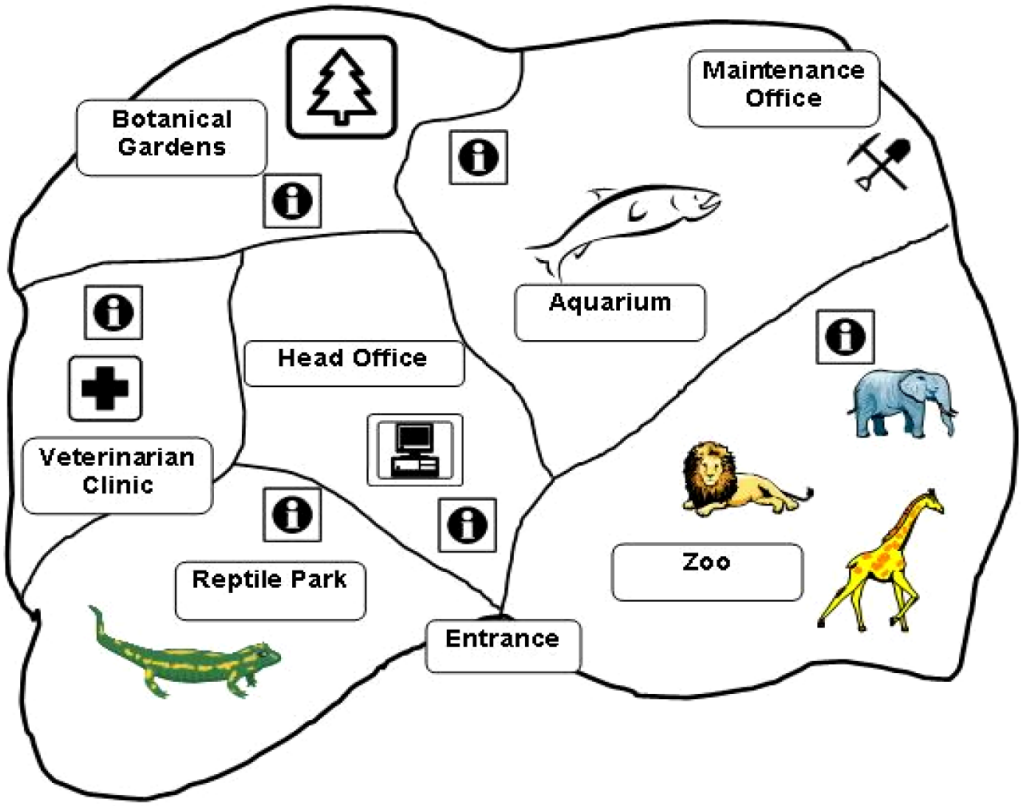
Question: 2.1.1 Write a mutator method called **setVisitDate** to receive a date as parameter and replace the current date to visit the aquarium with the date received. (2)
Discussion: This can be considered as a Routine Procedure in programming since Set and Get methods are common methods required in object oriented programs. Although there is a parameter included, the envisaged Grade 12 candidates should be quite comfortable with this.
Memorandum/Marking guidelines **Mutator method for setVisitDate:** Method definition with date parameter. √ Assign the parameter value to the attribute. √

TABLE 3: EXAMPLES OF QUESTIONS AT LEVEL 2: (UNDERSTANDING/APPLYING)

In general questions categorised as Level 2 questions include questions: • Testing the ability to explain ideas and concepts; and • Applying what has been learnt to new situations.
Example 1:
Question 2.1.2 (b), 2012, November Paper 2:

SCENARIO

The Red Feather Nature Park consists of various smaller parks, including a reptile park, an aquarium, a zoo and a botanical garden as indicated in the diagram below.



Each smaller park has its own administration offices with computers that are linked to a server at the head office. The head office is situated near the main entrance to the Park. Most of the administrative work is done here.

In a new project to serve the community, learners from various schools volunteer to work at the Red Feather Nature Park during their holidays. Some of the learners will work with the animals, feeding them, cleaning the cages, et cetera. Some of the learners will receive a short training course as guides. Your expertise as an IT learner is needed in a group that is assigned to Mr Eagle, the Park's administration manager. Your group will help solve hardware-, software- and network-related problems.

Your group will also assist with new technology that will be implemented where cellphones can be used during guided tours. The official website of the Park (www.redpark.co.za) also needs some attention.

2.1.2(b) The hard disk contains mostly photographs and is almost full. The new trend in hard drive storage devices is to increase the amount of data that can be stored in the same amount of space. Name ONE way in which this can be achieved. (1)

Discussion:
At first glance, this particular question could be seen as a Level 1 question because it appears to require the recall of factual information learnt in class. The action verb 'name' in this question suggests that this may be a 'remembering' question However, in this case, candidates need to *recognise* and *understand* from the information provided in the opening statement that they would need to *apply* vertical/perpendicular recording or file compression. In answering the question, candidates have to show that they understand the conditions under which to apply vertical/perpendicular recording or file compression. Although they should have gained knowledge of vertical/perpendicular recording on a hard drive or file compression from studying this section of the curriculum, here they have to show their understanding of the physical arrangement of data on a hard drive and apply their understanding in an actual situation to identify one way in which to achieve the goal of saving storage space.

Memorandum/Marking guidelines

Any one method:

- Reducing the size of the read/write heads/density of tracks
- Change the process of storing data e.g. using vertical/perpendicular recording
- Using file compression (1)

Example 2 – Scenario same as Example 1 above

Question 2.1.2 (a), 2012, November Paper 2:

2.1.2(a) All of the photographs, except those taken by the lead photographer at the Park, must be deleted. Fortunately, metadata was set up. Give ONE example of metadata that is applicable to this situation. (1)

Discussion:
The action verb 'give' suggests that this may be a 'remembering' question, however the question is classified as an 'understanding' and 'applying question because candidates need to understand the scenario and the type of data that is applicable to the scenario as well as what metadata is. Thereafter they need to apply their knowledge in order to suggest an example of metadata that is applicable. Although candidates should have gained knowledge of what metadata is from studying the relevant section of the curriculum, here they have to apply their knowledge of metadata in an actual scenario/situation. The question is classified as a Level 2 'understanding' and 'applying' question rather than a Level 3 'analysis' or 'creating' question because the problem is already identified i.e. that all of the photographs, except those taken by the lead photographer at the Park, must be deleted using metadata. Candidates do not have to 'analyse' the situation but simply have to show that they know and understand how metadata can be applied.

Memorandum/Marking guidelines

Any one of the following:

- Model of camera.
- Author (photographers name).
- Title/key words/comments/subject/category.
- Last saved by/Date last saved/Last printed.
- Revision number/Application name/Company.
- Date created. (1)

Example 3 – same Scenario as Example 1 and Example 2 above

Question 2.1.3 (b) (ii), 2012, November Paper 2:

2.1.3(b)(ii) Some of the learners in the group are of the opinion that, if there was enough virtual memory, there is no need to upgrade the RAM. Explain why virtual memory will not be the solution to better performance. (1)

Discussion:

Here the action verb 'explain' indicates that this might be an 'understanding' and 'applying' question. Indeed, candidates have to show their understanding of virtual memory by explaining why it is not a good solution to apply in this particular situation. Explaining an idea or concept requires *understanding* and, because candidates have to explain *why* virtual memory will not be the solution to better performance, they need to provide a relatively technical explanation. To answer the question, they also need to apply what they have learnt in an unfamiliar situation; it is unlikely that candidates would have encountered this particular scenario previously in the classroom. These factors raise the classification of the question to Level 2.

Memorandum/Marking guidelines

Any one of the following or appropriate valid explanation:

- Virtual memory is slow/using hard disk space as memory slows down the performance.
- Thrashing may occur.
- To be effective the need for a large amount of secondary storage (hard disk space) arises.

(1)

Example 4: Practical – Level 2

Question 2.2.1: DBE, November 2016, IT Paper 1

Synopsis of scenario on which question is based:

Aqua Wonderland is a water theme park that provides entertainment, access to restaurants, shopping, water slides and many more activities. The administrators of Aqua Wonderland are currently working on different techniques and strategies to improve the popularity of the park.

Aqua Wonderland is hosting a special five-day educational programme at the aquarium. Schools can arrange with the administrators at the park to take learners on

an excursion to the aquarium on any one of the specific days when the programme is hosted. When a school requests to visit the park on a specific date, the administrators will confirm whether the school can attend, depending on the space available to accommodate the group of learners.

Delphi programmers	Java programmers
• Open the incomplete program in the **Question2** folder. • Open the incomplete object class **Excursion_U.pas**. • Enter your examination number as a comment in the first line of both files **Question2_U.pas** and **Excursion_U.pas**.	• Open the incomplete program in the **Question2** folder. • Open the incomplete object class **Excursion.java**. • Enter your examination number as a comment in the first line of both classes **Question2.java** and **Excursion.java**.

Compile and execute the program. Currently, the program has no functionality. A hidden panel called **pnlAvailability** will not be visible when the program is executed and will be used in QUESTION 2.2.2 and QUESTION 2.2.3.
Example of user interface:

An incomplete class **Question2_U/Question2** is provided. Details of the school applying to go on an excursion to visit the aquarium must be entered by the user. The program must determine whether the school can be accommodated on the requested date and provide alternative dates if the school cannot be accommodated on the requested date.

Question:

2.2.1 **Button [2.2.1 – Instantiate object]**
The user needs to enter the name of the school, select the date on which they want to visit the aquarium from the list box and enter the number of learners in the group.

An **Excursion** object named **objExcursion** has been declared globally. Write code to use the data that was entered to instantiate a new **Excursion** object.
Display a message using a dialog box to indicate that the object has been instantiated successfully.

Discussion:
This programming example can be considered as a Multi-step Procedure since the learner is required to extract the data from the relevant components and use a correct selection statement and thereafter use the data to instantiate the object.

Memorandum/Marking guidelines

Button - [2.2.1 Instantiate object]
Extract the school name from the text box✓
Extract the date from the list box ✓
Extract the size of group from the text box and convert to integer type✓
If the check box is ticked ✓
    Set the tourGuide to true
else
    Set the tourGuide to false✓
Instantiate object with correct parameters✓
Display message to indicate that object is instantiated ✓ (7)

TABLE 4: EXAMPLES OF QUESTIONS AT LEVEL 3:

(ANALYSING/EVALUATING/CREATING)

In general questions categorised as Level 3 questions include questions requiring learners to:

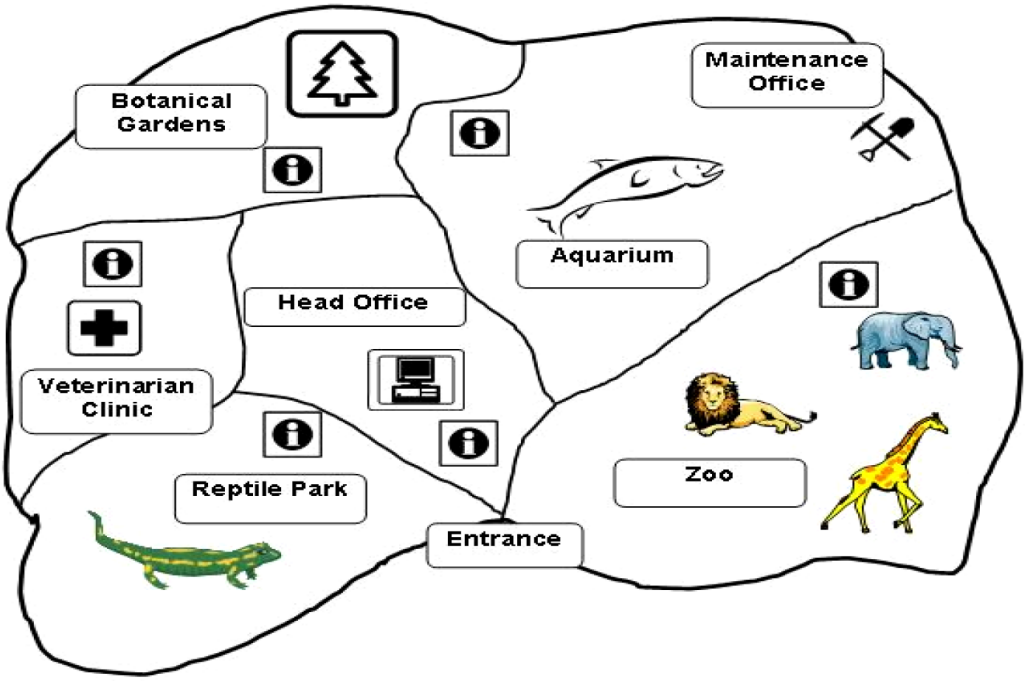
- break information into parts (synthesise) so as to explore understandings and relationships;
- make judgements and to justify a decision or course of action; and
- generate new ideas/solutions/ways of viewing concepts or constructing new meaning out of diverse elements.

Example 1:

Question 2.7.2, 2012, November Paper 2:

SCENARIO

The Red Feather Nature Park consists of various smaller parks, including a reptile park an aquarium, a zoo and a botanical garden as indicated in the diagram below.



Each smaller park has its own administration offices with computers that are linked to a server at the head office. The head office is situated near the main entrance to the Park. Most of the administrative work is done here.

In a new project to serve the community, learners from various schools volunteer to work at the Red Feather Nature Park during their holidays. Some of the learners will work with the animals, feeding them, cleaning the cages, et cetera. Some of the learners will receive a short training course as guides. Your expertise as an IT learner is needed in a group that is assigned to Mr Eagle, the Park's administration manager. Your group will help solve hardware-, software- and network-related problems.

Your group will also assist with new technology that will be implemented where cellphones can be used during guided tours. The official website of the Park (www.redpark.co.za) also needs some attention.

2.7.2 Give TWO practical examples of how GPS technology can be used at the park other than conducting GPS tours. (2)

Discussion:

The action verb 'give' suggests that this question may be a remembering question. However, it is classified as a higher order level question because in order to answer the question candidates are required to analyse the scenario and use their knowledge of GPS technology and think of other examples of how GPS technology can be used at the park. They need to be creative in a sense. Here candidates are engaged in inferential reasoning and interpretation and use their background knowledge of GPS technology.

Memorandum/Marking guidelines

Any two valid examples from scenario (zoo/reptile park/aquarium)

- Guiding someone to a specific animal enclosure.
- Give you information about the layout of the park.
- Together with audio feed it can give you information about animals at a specific location.
- Using satellite technology (GPS), audio and/or multimedia content is triggered based on a user's location in the park.

Example 2 – same Scenario as Example 1 above

Question 2.2.4, 2012, November Paper 2:

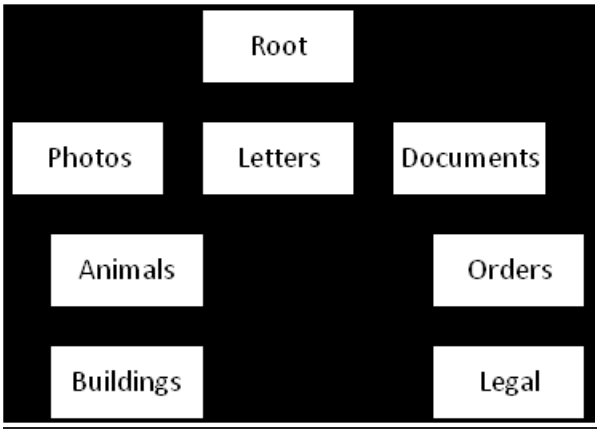
2.2.4 Currently all the photographs, letters and other documents, such as financial reports and order forms, are saved in the root folder on the hard drive. Draw a simple diagram of a folder structure to illustrate an improved structure for organising the files on a hard drive. Make provision for at least TWO levels of subfolders. (2)

Discussion:

This question is classified as a higher order question (Creating). To answer the question, candidates have to integrate ideas and information and relate parts of material, ideas, or information to one another and to an overall structure or purpose in a way that is relational and coherent. They also, have to engage in original creative thought and design and put elements together to form a coherent whole and compile component ideas into a new whole or propose alternate solutions. Candidates have to analyse existing directory structure (root directory) and evaluate it or be critical and then create a new directory structure which will alleviate problems identified with existing structure. An alternate solution for the directory is being provided, which should be an improved structure using sub-folders.

Memorandum/Marking guidelines

Accept any correct labelled visual diagram of a file structure showing three levels of file management. √√



Example 3 – same scenario as Example 1 and Example 2 above

Question 4.4, 2012, November Paper 2:

4.4 The human resources department is considering requesting access to the Facebook profiles of new employees in order to find out more about them. Do you think this is ethical? Justify your answer.

Discussion:

This question is classified as a higher order question (evaluation). Candidates are expected to make a critical ***judgment*** on an ethical issue, that is whether accessing individuals' private Facebook© profiles is acceptable or not. The candidate will need to use criteria based on sources from organisations of authority, one's own experiences or values, or background information from the subject curriculum to substantiate the position that the candidate takes. The candidate could also use government policy on this issue and substantiate his/her choice.

Memorandum/Marking guidelines

YES or NO

NOTE: Must be supported by a valid reason to get the marks

Accept ONE correct explanation

If answered YES:

- The company has the right to know what type of person they are employing.
- The employee may be a potential embarrassment to the company due to his statements on Facebook.
- By viewing the profile, the company may prevent victimization of other employees.

If answered NO:

- It is intrusive on a person's private life.
- An employee has the right to confidentiality provided they do not do anything that jeopardizes the organization they work for.
- The constitution protects freedom of speech and association.

(2)

Example 4: Practical – Level 3:

Question 3.2: DBE, November 2016, IT Paper 1

Synopsis of scenario on which question is based:

SCENARIO

Aqua Wonderland is a water theme park that provides entertainment, access to restaurants, shopping, water slides and many more activities. The administrators of Aqua Wonderland are currently working on different techniques and strategies to improve the popularity of the park.

Information centres, referred to as 'terminals', have been set up at three different points along the routes in the park. The management requires a software program

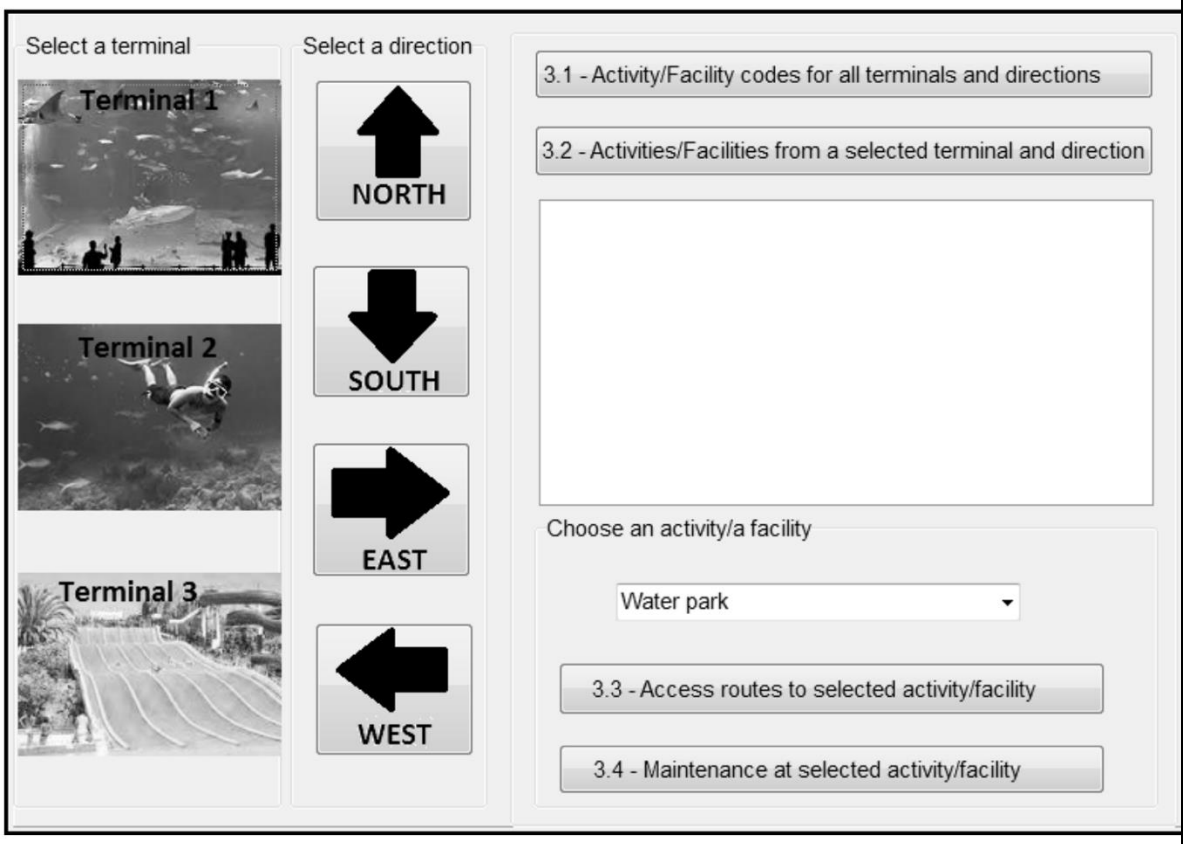
to provide information to visitors to locate the different activities and facilities at Aqua Wonderland and to be aware of maintenance activities in the park.

Do the following:

- Compile and execute the program in the **Question3** folder. Currently, the program has no functionality.
- Complete the code for each question as described in QUESTION3.1 to ...

Supplied GUI

The supplied GUI represents a self-help interface to assist visitors in reaching various activities and facilities within the park.



Supplied data:

You are provided with two parallel arrays and one two-dimensional array.

arrActivities is a one-dimensional array that contains the names of activities and facilities in the park. The data stored in this array are as follows:

Water park, Aquarium, Sea, Restaurants, Shopping, Diving, Help desk, Penguin park, Shark tank, Dolphin shows.

A corresponding parallel array called **arrCodes** contains letters from the alphabet, each representing the corresponding activity/facility described in the **arrActivities** array.

The **arrCodes** array contains the following elements:

W, A, S, R, X, D, H, P, T, L

The first element (letter W) in the **arrCodes** array represents the first element ('Water park') in the **arrActivities** array, the second element (letter A) in the **arrCodes** array represents the second element ('Aquarium') in the **arrActivities** array, and so on.
arrActCodes is a two-dimensional array that contains a combination of codes that represent activities and facilities that are accessible from a specific terminal when the visitor departs in a specific direction. The codes contained in this array are as follows:

	North	South	East	West
Terminal 1	DXWAT	HRDST	STWLP	RDT
Terminal 2	SWA	SRXD	LWXH	SHA
Terminal 3	WLSR	AT	DATX	HW

NOTE: The row and column headings are not provided as part of the two-dimensional array.
Example:
The activity code that applies when a visitor walks from Terminal 1 in a northerly direction is DXWAT.
Using the content of the **arrCodes** and **arrActivities** arrays, it can be established that the activities and facilities that the code DXWAT refers to are Diving, Shopping, Water park, Aquarium and Shark tank.

- You are NOT allowed to modify supplied data manually. Code must be written to manipulate the supplied data according to the requirements.

The use of good programming techniques and modular design must be applied in the design and coding of your solution.

Question:

3.2 Button [3.2 – Activities/Facilities from a selected terminal and direction]
The buttons that contain images must be used to select a terminal and direction. Code is provided to assign the selected terminal and direction to variables. The program must then use the supplied arrays to identify all the activities and facilities available on the selected route. Display the selected terminal and direction as a heading and a list of activities and facilities on the route selected.

Example of output if Terminal 2 and South are selected

```
Terminal 2, South
Sea
Restaurants
Shopping
Diving
```

(11)

Discussion: This example is considered level three since it has much problem solving. As part of the solution, candidates are required to extract code from the 2D array and then loop through the code and loop through the arrCodes array. Each letter of the code must be compared to the values in the arrCodes array. The corresponding activities from ArrActivities that have the same index as in arrCodes must be displayed.
Memorandum/Marking guidelines **Button [3.2 – Activities/Facilities from a selected terminal and direction]** Display the terminal number ✓and the direction in the output area. ✓ Extract the code from the twoD array at this terminal number ✓ and in this direction. ✓ Loop through the length of the extracted code ✓ Loop through the arrCodes array. ✓ Compare each letter in the code ✓to the values in the arrCodes array. ✓ Display the activity from the arrActivities array ✓at the same index ✓as in the arrCodes. ✓array

To accomplish the goal of discriminating between high achievers, those performing very poorly, and all candidates in between, examiners need to vary the challenge of examination questions. Until recently, the assumption has been that 'alignment' with the allocated percentage of marks for questions at the required cognitive demand levels meant that sufficient examination questions were relatively easy; moderately challenging; and difficult for candidates to answer.

However, research and candidate performance both indicate that a range of factors other than type of cognitive demand contribute to the cognitive challenge of a question. Such factors include the level of content knowledge required, the language used in the question, and the complexity or number of concepts tested. In other words, cognitive demand levels on their own do not necessarily distinguish between degrees of difficulty of questions.

This research helps, to some extent, explain why, despite that some NSC examination papers have complied with the specified cognitive demand weightings stipulated in the policy, they have not adequately distinguished

between candidates with a range of academic abilities in particular between higher ability candidates. As a result, examiners, moderators and evaluators are now required to assess the difficulty level of each examination question in addition to judging its cognitive demand.

Section 7 below explains the new protocol introduced by Umalusi for analysing examination question difficulty.

7 ANALYSING THE LEVEL OF DIFFICULTY OF EXAMINATION QUESTIONS

When analysing the level of difficulty of each examination question, there are six important protocols to note. These are:

1. Question difficulty is **assessed independently** of the type and level **of cognitive demand**.
2. Question difficulty is assessed against **four levels of difficulty**.
3. Question difficulty is determined against the assumed capabilities of the **ideal** '**envisaged'** Grade 12 Information Technology NSC examination **candidate**.
4. Question difficulty is determined using **a common framework** for thinking about question difficulty.
5. Question difficulty entails **distinguishing unintended sources of difficulty** or ease **from intended sources of difficulty** or ease.
6. Question difficulty entails identifying **differences** in levels of difficulty **within a single question**.

Each of the above protocols is individually explained and discussed below.

7.1 Question difficulty is assessed independently of the type and level of cognitive demand

As emphasised earlier in this exemplar book, the revised Umalusi NSC examination evaluation instruments separate the analysis of the type of cognitive demand of a question from the analysis of the level of difficulty of each examination question. Cognitive demand describes the *type of cognitive process* that is required to answer a question, and this does not necessarily equate or align with the *level of difficulty* of other aspects of a question, such as the difficulty of the content knowledge that is being assessed. For example, a recall question can ask a candidate to recall very complex and abstract scientific content. The question would be categorised as Level 1 in terms of the cognitive demand taxonomy but may be rated as 'difficult' (Level 3 Table 5 below).

Note:
Cognitive demand is just one of the features of a question that can influence your comparative judgments of question difficulty. The type and level of cognitive process involved in answering a question does not necessarily determine how difficult the question would be for candidates. Not all evaluation/ synthesis/analysis questions are more difficult than questions involving lower-order processes such as comprehension or application.

7.2 Question difficulty is assessed at four levels of difficulty

The revised Umalusi NSC examination evaluation instruments require evaluators to exercise expert judgments about whether each examination question is 'Easy', 'Moderately challenging', 'Difficult' or 'Very difficult' for the envisaged Grade 12 learner to answer. Descriptions of these categories of difficulty are shown in Table 5.

TABLE 5 LEVELS OF DIFFICULTY OF EXAMINATION QUESTIONS

1	2	3	4
Easy for the envisaged Grade 12 student to answer.	**Moderately challenging** for the envisaged Grade 12 student to answer.	**Difficult** for the envisaged Grade 12 student to answer.	**Very difficult** for the envisaged Grade 12 student to answer. The skills and knowledge required to answer the question allow for the top students (*extremely* high-achieving/ability students) to be discriminated from other high achieving/ability students).

Note:
The forth level, 'very difficult' has been included in the levels of difficulty of examination questions to ensure that there are sufficient questions that discriminate well amongst higher ability candidates.

7.3 Question difficulty is determined against the assumed capabilities of the ideal 'envisaged' Grade 12 Information Technology NSC examination candidate

The revised Umalusi NSC examination evaluation instruments require evaluators to exercise expert judgments about whether each examination question is 'Easy', 'Moderately challenging', 'Difficult' or 'Very difficult' for the '**envisaged**' Grade 12 learner to answer (Table 5). In other words, assessment of question difficulty is linked to a particular target student within the population of NSC candidates, that is, the Grade 12 candidate of average intelligence or ability.

The Grade 12 learners that you may have taught over the course of your career cannot be used as a benchmark of the 'envisaged' candidate as we cannot

know whether their abilities fall too high, or too low on the entire spectrum of all Grade 12 Information Technology candidates in South Africa. The revised Umalusi NSC examination evaluation instruments thus emphasise that, when rating the level of difficulty of a particular question, your conception of the 'envisaged' candidate needs to be representative of the entire population of candidates for all schools in the country, in other words, of the overall Grade 12 population.

Most importantly, the conception of this 'envisaged' candidate is a learner who has been taught the whole curriculum adequately by a teacher who is qualified to teach the subject, in a functioning school. There are many disparities in the South African education system that can lead to very large differences in the implementation of the curriculum. Thus this 'envisaged' learner is not a typical South African Grade 12 learner – it is an intellectual construct (an imagined person) whom you need to imagine when judging the level of difficulty of a question. This ideal 'envisaged' Grade 12 learner is an aspirational ideal of where we would like all Information Technology learners in South Africa to be.

Note:
The concept of the ***ideal envisaged Grade 12 candidate is*** that of an imaginary learner who has the following features:

a. Is of average intelligence or ability
b. Has been taught by a competent teacher
c. Has been exposed to the entire examinable curriculum

This envisaged learner represents an imaginary person who occupies the middle ground of ability and approaches questions *having had all the necessary schooling.*

7.4 Question difficulty is determined using a common framework for thinking about question difficulty

Examiners, moderators and evaluators **in all subjects** are now provided with a common framework for thinking about question difficulty to use when

identifying sources of difficulty or ease in each question, and to provide their reasons for the level of difficulty they select for each examination question.

The framework described in detail below provides the main sources of difficulty or 'ease' inherent in questions. The four sources of difficulty which must be considered when thinking about the level of difficulty of examination questions in this framework are as follows.

1. '**Content difficulty'** refers to the difficulty inherent in the subject matter and/or concept/s assessed.
2. '**Stimulus difficulty'** refers to the difficulty that candidates confront when they attempt to read and understand the question and its source material. The demands of the reading required to answer a question thus form an important element of 'stimulus difficulty'.
3. '**Task difficulty'** refers to the difficulty that candidates confront when they try to formulate or produce an answer. The level of cognitive demand of a question forms an element of 'Task difficulty', as does the demand of the written text or representations that learners are required to produce for their response.
4. **'Expected response difficulty'** refers to difficulty imposed by examiners in a marking guideline, scoring rubric or memorandum. For example, mark allocations affect the amount and level of answers students are expected to write.

This framework derived from Leong (2006) was chosen because it allows the person making judgments about question difficulty to grapple with nuances and with making connections. The underlying assumption is that judgment of question difficulty is influenced by the interaction and overlap of different aspects of the four main sources of difficulty. Whilst one of the above four sources of difficulty may be more pronounced in a specific question, the other three sources may also be evident. Furthermore, not all four sources of difficulty need to be present for a question to be rated as difficult.

The four-category conceptual framework is part of the required Umalusi examination evaluation instruments. Each category or source of difficulty in this framework is described and explained in detail below (Table 6). Please read the entire table very carefully.

TABLE 6: FRAMEWORK FOR THINKING ABOUT QUESTION DIFFICULTY

CONTENT/CONCEPT DIFFICULTY
Content/concept difficulty indexes the difficulty in the **subject matter, topic or conceptual knowledge** assessed or required. In this judgment of the item/question, difficulty exists in the **academic and conceptual demands** that questions make and/or the **grade level** boundaries of the various 'elements' of domain/subject knowledge (topics, facts, concepts, principles and procedures associated with the subject).
For example:
Questions that assess '**advanced content'**, that is, subject knowledge that is considered to be in advance of the grade level curriculum, are *likely* to be difficult or very difficult for most candidates. Questions that assess subject knowledge which forms part of the core curriculum for the grade are *likely* to be moderately difficult for most candidates. Questions that assess **'basic content'** or subject knowledge candidates would have learnt at lower grade levels, and which would be familiar to them are *unlikely* to pose too much of a challenge to most candidates. Questions that require general everyday knowledge or knowledge of 'real life' experiences are *often* easier than those that test more **specialized** school **knowledge**. Questions involving only concrete objects, phenomena, or processes are *usually* easier than those that involve more **abstract constructs, ideas, processes or modes.** Questions which test learners' understanding of theoretical or **de-contextualised issues or topics**, rather than their knowledge of specific examples or contextualised topics or issues *tend* to be more difficult. Questions involving familiar, contemporary/current contexts or events are *usually* easier than those that are more **abstract or** involve **'imagined' events** (e.g. past/future events) or **contexts** that are **distant from learners' experiences.** Content difficulty may also be varied by changing **the number of knowledge elements or operations assessed**. *Generally,* the difficulty of a question increases with the number of knowledge elements or operations assessed. Questions that assess learners on two or more knowledge elements or operations are *usually* (but not always) more difficult than those that assess a single knowledge element or operation. Assessing learners on **a combination of knowledge elements or operations that are seldom combined** *usually* increases the level of difficulty.

STIMULUS DIFFICULTY

Stimulus difficulty refers to the difficulty of the linguistic **features of the question** (**linguistic** complexity) and the challenge that candidates face when they attempt to read, interpret and understand the words and phrases in the question AND when they attempt to read and understand the **information or 'text' or source material (diagrams, tables and graphs, pictures, cartoons, passages, etc.) that accompanies the question.**

For example:

Questions that contain words and phrases that require only simple and straightforward comprehension are *usually* easier than those that require the candidate to understand **subject specific phraseology and terminology** (e.g. idiomatic or grammatical language not usually encountered in everyday language), or that require more technical comprehension and specialised command of words and language (e.g. everyday words involving different meanings within the context of the subject).

Questions that contain information that is 'tailored' to an expected response, that is, questions that contain no irrelevant or distracting information, are *generally* easier than those that require candidates to select relevant and appropriate information or **unpack a large amount of information** for their response. A question **set in a very rich context** *can* increase question difficulty. For example, learners *may* find it difficult to select the correct operation when, for example, a mathematics or accountancy question is set in a context-rich context.

Although the level of difficulty in examinations is *usually* revealed most clearly through the questions, text complexity or the degree of **challenge or complexity in written or graphic texts** (such as a graph, table, picture, cartoon, etc.) that learners are required to read and interpret in order to respond *can* increase the level of difficulty. Questions that depend on reading and selecting content from a text *can* be more challenging than questions that do not **depend on actually reading the accompanying text** because they test reading comprehension skills as well as subject knowledge. Questions that require candidates to **read a lot** *can* be more challenging than those that require limited reading. Questions that tell learners where in the text to look for relevant information are *usually* easier than those where **learners are not told where to look**.

The level of difficulty *may* increase if texts set, and reading passages or other **source material** used are challenging for the grade level, and make **high reading demands** on learners at the grade level. Predictors of textual difficulty include

- **semantic content** – for example, if vocabulary and words used are typically outside the reading vocabulary of Grade 12 learners, 'texts' (passage, cartoon, diagram, table, etc.) are *usually* more difficult. 'Texts' are *generally* easier if words or images are made accessible by using semantic/context, syntactic/structural or graphophonic/visual cues.
- **syntactic or organisational structure** – for example, sentence structure and length. For example, if learners are likely to be *familiar with the structure* of the 'text' or resource, for example, from reading newspapers or magazines, etc. 'texts' are *usually* easier than when the structure is unfamiliar.
- **literary techniques** – for example, abstractness of ideas and imagery – and **background knowledge required**, for example, to make sense of allusions.

- if the **context** is **unfamiliar** or remote, or if candidates do not have or are **not provided with access to the context** which informs a text (source material, passage, diagram, table, etc.) they are expected to read, and which informs the question they are supposed to answer and the answer they are expected to write, then constructing a response is *likely* to be more difficult than when the context is provided or familiar.

Questions which require learners to **cross-reference different sources** are *usually* more difficult than those which deal with one source at a time.

Another factor in stimulus difficulty is presentation and visual appearance. For example, type face and size, use of headings, and other types of textual organisers etc. can aid **'readability'** and make it easier for learners to interpret the meaning of a question.

EXAMPLES OF INVALID OR UNINTENDED SOURCES OF STIMULUS DIFFICULTY

- Meaning of words unclear or unknown.
- Difficult or impossible to work out what the question is asking.
- Questions which are ambiguous.
- Grammatical errors in the question that could cause misunderstanding.
- Inaccuracy or inconsistency of information or data given.
- Insufficient information provided.
- Unclear resource (badly drawn or printed diagram, inappropriate graph, unconventional table).
- Dense presentation (too many important points packed in a certain part of the stimulus).

TASK DIFFICULTY

Task difficulty refers to the **difficulty that candidates confront when they try to formulate or produce an answer**.

For example:

In most questions, to generate a response, candidates have to work through the steps of a solution. *Generally*, questions that **require more steps in a solution** are more difficult than those that require fewer steps. Questions involving only one or two steps in the solution are *generally* easier than those where several operations required for a solution**.**

Task difficulty may also be mediated by the **amount of guidance present in the question**. Although question format is not necessarily a factor and difficult questions can have a short or simple format, questions that provide guided steps or cues (e.g. a clear and detailed framework for answering) are *generally* easier than those that are more open ended and require candidates to form or tailor their **own response strategy** or argument, work out the steps **and maintain the strategy for answering** the question by themselves. A high degree of prompting (a high degree of prompted recall, for example) *tends* to reduce difficulty level.

Questions that test specific knowledge are *usually* less difficult that **multi-step, multiple-concept or operation questions**.

A question that requires the candidate to **use** a **high level of** appropriate **subject specific, scientific or specialised terminology in** their **response** *tends* to be more difficult than one which does not.

A question requiring candidates to **create a complex abstract (symbolic or graphic) representation** is *usually* more challenging than a question requiring candidates to create a concrete representation.

A question requiring writing a one-word answer, a phrase, or a simple sentence is *often* easier to write than **responses that require more complex sentences, a paragraph or a full essay or composition**.

Narrative or descriptive writing, for example where the focus is on recounting or ordering a sequence of events chronologically, is *usually* easier than **writing discursively** (**argumentatively or analytically**) where ideas need to be developed and ordered logically. Some questions reflect task difficulty simply by **'creating the space' for A-grade candidates** to demonstrate genuine insight, original thought or good argumentation, and to write succinctly and coherently about their Knowledge.

Another element is the **complexity in structure of the required response**. When simple connections between ideas or operations are expected in a response, the question is *generally* easier to answer than a question in which the significance of the relations between the parts and the whole is expected to be discussed in a response. In other words, a question in which an unstructured response is expected is *generally* easier than a question in which **a relational response** is required. A response which involves **combining or linking a number of complex ideas or operations** is *usually* more difficult than a response where there is no need to combine or link ideas or operations.

On the other hand, questions which require continuous prose or extended writing *may* also be easier to answer correctly or to get marks for than questions that require no writing at all or single letter answer (such as multiple choice), or a brief response of one or two words or short phrase/s because they **test very specific Knowledge**.

The **cognitive demand** or **thinking processes** required form an aspect of task difficulty. Some questions test thinking ability, and learners' capacity to deal with ideas, etc. Questions that assess inferential comprehension or application of Knowledge, or that require learners to take ideas from one context and use it in another, for example, *tend* to be more difficult than questions that assess recognition or retrieval of basic information. On the other hand, questions requiring recall of Knowledge are *usually* more difficult than questions that require simple recognition processes.

When the **resources for answering** the question are included in the examination paper, then the task is *usually* easier than when candidates have to **use and select their own internal resources** (for example, their own Knowledge of the subject) or transform information to answer the question.

Questions that require learners to take or **transfer** ideas, **skills or Knowledge from one context/subject area and use them in another** *tend* to be more difficult.

EXAMPLES OF INVALID OR UNINTENDED SOURCES OF TASK DIFFICULTY

- Level of detail required in an answer is unclear.
- Context is unrelated to or uncharacteristic of the task than candidates have to do.
- Details of a context distract candidates from recalling or using the right bits of their Knowledge.
- Question is unanswerable.
- Illogical order or sequence of parts of the questions.
- Interference from a previous question.
- Insufficient space (or time) allocated for responding.
- Question predictability or task familiarity. If the same question regularly appears in examination papers or has been provided to schools as exemplars, learners are likely to have had prior exposure, and practised and rehearsed answers in class (for example, when the same language set works are prescribed each year).
- Questions which involve potential follow-on errors from answers to previous questions.

EXPECTED RESPONSE DIFFICULTY

Expected response difficulty refers to difficulty imposed by examiners in a **mark scheme and memorandum**. This location of difficulty is more applicable to 'constructed' response questions, as opposed to 'selected' response questions (such as multiple choice, matching/true-false).

For example:

When examiners expect few or no details in a response, the question is *generally* easier than one where the mark scheme implies that **a lot of details are expected**.

A further aspect of expected response difficulty is the clarity of the **allocation of marks**. Questions are *generally* easier when the allocation of marks is explicit, straight-forward or logical (i.e. 3 marks for listing 3 points) than when the **mark allocation is indeterminate or implicit** (e.g. when candidates need all 3 points for one full mark or 20 marks for a discussion of a concept, without any indication of how much and what to write in a response). This aspect affects difficulty because candidates who are unclear about the mark expectations in a response may not produce sufficient amount of answers in their response that will earn the marks that befit their ability.

Some questions are more difficult/easy to mark accurately than others. Questions that are **harder to mark and score objectively** are *generally* more difficult for candidates than questions that require simple marking or scoring strategies on the part of markers. For example, recognition and recall questions are *usually* easier to test and mark objectively because they usually require the use of matching and/or simple scanning strategies on the part of markers. More complex questions requiring analysis (breaking down a passage or material into its component parts), evaluation (making judgments, for example, about the worth of material or text, or about solutions to a problem), synthesis (bringing together parts or elements to form a whole), and creativity (presenting own ideas or original thoughts) are *generally*

harder to mark/score objectively. The best way to test for analysis, evaluation, synthesis and creativity is usually through extended writing. Such extended writing *generally* requires the use of more cognitively demanding *marking* strategies such as interpreting and evaluating the logic of what the candidate has written.

Questions where **a wide range of alternative answers or response/s** is possible or where the correct answer may be arrived at through different strategies *tend* to be more difficult. On the other hand, questions may be so open-ended that learners will get marks even if they engage with the task very superficially.

EXAMPLES OF INVALID OR UNINTENDED SOURCES OF EXPECTED RESPONSE DIFFICULTY

- Mark allocation is unclear or illogical. The weighting of marks is important in questions that comprise more than one component when components vary in levels of difficulty. Learners may be able to get the same marks for answering easy component/s of the item as other learners are awarded for answering the more difficult components.
- Mark scheme and questions are incongruent. For example, there is no clear correlation between the mark indicated on the question paper and the mark allocation of the memorandum.
- Question asked is not the one that examiners want candidates to answer. Memorandum spells out expectation to a slightly different question, not the actual question.
- Impossible for candidate to work out from the question what the answer to the question is (answer is indeterminable).
- Wrong answer provided in memorandum.
- Alternative correct answers from those provided or spelt out in the memorandum are also plausible.
- The question is 'open' but the memo has a closed response. Memo allows no leeway for markers to interpret answers and give credit where due.

The framework described above does not provide you with explicit links between the different sources of difficulty, or show relationships and overlaps between the different categories and concepts in the framework. This is because it is impossible to set prescribed rules or pre-determined combinations of categories and concepts used for making judgments about the source of difficulty in a particular examination question.

The intention behind the framework is to allow you to exercise your sense of judgment as an expert. The complexity of your judgment lies in your ability as an expert to recognise subtle interactions and identify links between different

categories of a question's difficulty or ease. For example, a question that tests specific knowledge of your subject can actually be more difficult that a multi-step question because it requires candidates to explain a highly abstract concept, or very complex content. In other words, although questions that test specific knowledge are *usually* less difficult than multiple-concept or operation questions, the level of difficulty of the content knowledge required to answer a question can make the question more difficult than a multi-step or multi-operation question.

Not all one-word response questions can automatically be assumed to be easy. For example, multiple-choice questions are not automatically easy because a choice of responses is provided – some can be difficult. As an expert in your subject, you need to make these types of judgments about each question.

Note:
It is very important that you become extremely familiar with the framework explained in Table 6, and with each category or source of difficulty provided (i.e. content difficulty, task difficulty, stimulus difficulty, and expected response difficulty). You need to understand the examples of questions which illustrate each of the four levels (Table 7 to Table 10). This framework is intended to assist you in discussing and justifying your decisions regarding the difficulty level ratings of questions. You are expected to **refer to all four categories or sources of difficulty** in justifying your decisions.

When considering question difficulty ask:

- How difficult is the **knowledge** (content, concepts or procedures) that is being assessed for the envisaged Grade 12 candidate? (*Content difficulty*)
- How difficult is it for the envisaged I Grade 12 candidate to formulate the answer to the question? In considering this source of difficulty, you should **take into account the type of cognitive demand** made by the task. (*Task difficulty*)
- How difficult is it for the envisaged Grade 12 candidate to **understand the question and the source material** that need to be read to answer the particular question? (*Stimulus difficulty*)
- What does the **marking memorandum and mark scheme** show about the difficulty of the question? (*Expected response difficulty*)

7.5 Question difficulty entails distinguishing unintended sources of difficulty or ease from intended sources of difficulty or ease

Close inspection of the framework for thinking about question difficulty (Section 7.4, Table 6) above, shows that, for each general category or source of difficulty, the framework makes a distinction between 'valid' or intended, and 'invalid' or unintended sources of question difficulty or ease. Therefore, defining question difficulty entails identifying whether sources of difficulty or ease in a question were intended or unintended by examiners. Included in Table 6 are examples of unintended sources of difficulty or ease for each of the four categories.

Valid difficulty or 'easiness' in a question has its source in the requirements of the question, and is ***intended*** by the examiner (Ahmed and Pollit, 1999). Invalid sources of difficulty or 'easiness' refer to those features of question difficulty or 'easiness' that were ***not intended*** by the examiner. Such unintended 'mistakes' or omissions in questions can prevent the question from assessing what the examiner intended, and are likely to prevent candidates from demonstrating their true ability or competence, and can result in a question being easier or more difficult than the examiner intended.

For example, grammatical errors in a question that could cause misunderstanding for candidates are unintended sources of question difficulty because the difficulty in answering the question could lie in the faulty formulation of the question, rather than in the intrinsic difficulty of the question itself (for example, because of stimulus difficulty). Candidates "may misunderstand the question and therefore not be able to demonstrate what they know" (Ahmed and Pollit, 1999, p.2). Another example is question predictability (when the same questions regularly appear in examination papers or textbooks) because familiarity can make a question which was intended to be difficult, less challenging for examination candidates.

Detecting unintended sources of difficulty or ease in examinations is largely the task of moderators. Nevertheless, evaluators also need to be vigilant about detecting sources which could influence or alter the intended level of question difficulty that moderators may have overlooked.

Note:
When judging question difficulty, you should distinguish **unintended sources of question difficulty or ease** from those sources that are intended, thus ensuring that examinations have a range of levels of difficulty. The framework for thinking about question difficulty allows you to systematically identify technical and other problems in each question. Examples of problems might be: unclear instructions, poor phrasing of questions, the provision of inaccurate and insufficient information, unclear or confusing visual sources or illustrations, incorrect use of terminology, inaccurate or inadequate answers in the marking memorandum, and question predictability. You should **not** rate a question as difficult/easy if the source of difficulty/ease lies in the 'faultiness' of the question or memorandum. Instead, as moderators and evaluators, you need to alert examiners to unintended sources of difficulty/ease so that they can improve questions and remedy errors or sources of confusion before candidates write the examination.

7.6 Question difficulty entails identifying differences in levels of difficulty within a single question

An examination question can incorporate more than one level of difficulty if it has subsections. It is important that the components of such questions are 'broken down' into to their individual levels of difficulty.

Note:
Each subsection of a question should be analysed separately so that the percentage of marks allocated at each level of difficulty and the weighting for each level of difficulty can be ascertained as accurately as possible for that question.

8. EXAMPLES OF QUESTIONS AT DIFFERENT LEVELS OF DIFFICULTY

This section provides at least **three** examples of questions from previous Information Technology NSC examinations (Table 7 to Table 10) categorised at each of the four levels of difficulty described in Section 7 (Table 5) above. These examples were selected to represent the **best and clearest** examples of each level of difficulty that the Information Technology experts could find. The discussion below each example question tries to explain the reasoning behind the judgments made about the categorisation of the question at that particular level of difficulty.

TABLE 7: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 1 – EASY

Example 1:
Question 2.1.1(a), 2012, November Paper 2: Define the term *refresh rate*. (2)
Discussion: This question is classified as 'easy' because: • The question is short and does not require much reading. The instructions are clear and unambiguous. The question is also clear and unambiguous. The words and phrases used in the question are simple and straightforward. The only technical term in the question is 'refresh rate'. This term should be familiar to Grade 12 IT candidates **(stimulus)**. • It assesses 'basic content' or subject knowledge that candidates would have learnt at this grade level. The term "refresh rate" should be familiar to all Grade 12 candidates and providing a definition should not pose any challenge to the envisaged Grade 12 candidate **(content)**. • This question simply requires remembering and writing the definition of "refresh rate" **(task)**. • 2 marks are allocated for writing a simple definition. Thus, the mark allocation and marking of the question is straightforward **(expected response)**. The question is thus 'easy' in relation to all four possible sources of difficulty.
Memorandum/Marking guidelines Refresh rate is the number of times/speed of how often √ the screen must be redrawn per second. √ (2)

Example 2:

Question 2.1.2(a) (i), 2012, November Paper 2:

What is *metadata?* (2)

Discussion:

This question is classified as 'easy' because:

- The question is short and makes low reading demands on candidates. The instruction is very clear. The only technical term used is the word 'metadata' –a term which should be familiar to all Grade 12 IT candidates **(stimulus)**.
- The question assesses subject knowledge that all Grade 12 candidates should have learnt about in class and through their textbooks. This 'basic content' should be familiar to them and is *unlikely* to pose any challenge to the envisaged Grade 12 candidate **(content)**.
- This question simply requires recognizing and remembering the term 'metadata' and writing a short definition or description **(task)**.
- Candidates only have to write one short sentences or phrase to obtain 2 marks. The mark allocation is straightforward **(expected response)**.

This question is thus easy in regard to all four sources of difficulty in the framework.

Memorandum/Marking guidelines

Metadata is data √ about data. √ (2)

Example 3:

Question 2.1.3 (b) (i), 2012, November Paper 2: **(Adapted)**

Define *virtual memory*. (2)

Discussion:

This question is classified as 'easy' because:

- The question is short and does not require much reading. The instructions are clear and unambiguous. The question is easy to understand. The term 'virtual memory' should be familiar to all Grade 12 IT candidates **(stimulus)**.
- The question assesses 'basic content' or subject knowledge that Grade 12 candidates would have learnt about in class and through their textbooks. The content should be familiar to them and is unlikely to pose any challenge to the envisaged Grade 12 candidate **(content)**.
- The action verb is 'define' – all candidates are required to do to answer this question is state what the term 'virtual memory' means. The task is not conceptually demanding as they can simply provide a learnt definition retrieved from memory **(task)**.
- Two marks are allocated for writing a one-sentence or phrase explanation making one point. The mark allocation is thus straightforward. The envisaged Grade 12 candidate should easily obtain full marks for this question **(expected response)**.

Thus, the question is easy in regard to all four sources of difficulty in the framework (content, stimulus, task, and expected response).

Memorandum/Marking guidelines

The operating system uses secondary storage ✓ (hard drive) space as memory ✓ (temporary or simulated or additional RAM). (2)

Example 4 – Practical:

Question 2.1.1: DBE, November 2016, IT Paper 1,

Synopsis of scenario on which question is based:

Aqua Wonderland is hosting a special five-day educational programme at the aquarium. Schools can arrange with the administrators at the park to take learners on an excursion to the aquarium on any one of the specific days when the programme is hosted. When a school requests to visit the park on a specific date, the administrators will confirm whether the school can attend, depending on the space available to accommodate the group of learners.

Delphi programmers	**Java programmers**
• Open the incomplete program in the **Question2** folder. • Open the incomplete object class **Excursion_U.pas**. • Enter your examination number as a comment in the first line of both files **Question2_U.pas** and **Excursion_U.pas**.	• Open the incomplete program in th **Question2** folder. • Open the incomplete object class **Excursion.java**. • Enter your examination number as c comment in the first line of both classes **Question2.java** and **Excursion.java**. .

Compile and execute the program. Currently, the program has no functionality. A hidden panel called **pnlAvailability** will not be visible when the program is executed and will be used in QUESTION 2.2.2 and QUESTION 2.2.3.

Example of user interface:

2.1 The given incomplete object class (**TExcursion/Excursion**) contains the declaration of four attributes and methods which describe an Excursion object.

The attributes for the **Excursion** object are as follows:

NAMES OF ATTRIBUTES		DESCRIPTION
Delphi	**Java**	
fSchoolName	schoolName	The name of the school
fVisitDate	visitDate	The date the school wants to visit the aquarium in th format YYYY-MM-DD
fGroupSize	groupSize	The number of learners in the group
fTourGuide	tourGuide	A Boolean attribute with the value of 'true' if the school requires a tour guide or 'false' if the school does not require a tour guide

Complete the code in the given Excursion object class (TExcursion/Excursion) as described in QUESTION 2.1.1 ...

Question:

2.1.1 Write a mutator method called **setVisitDate** to receive a date as parameter and replace the current date to visit the aquarium with the date received. (2)

Discussion:

Set and Get methods in OOP are common routine constructs which candidates would have done for almost all programs which they design. No grade 12 learner should have any difficulty with this.

- The question is short and makes low reading demands on candidates. The instruction is very clear. The terminology used should be familiar to all Grade 12 IT candidates **(stimulus)**.
- The question assesses subject knowledge that all Grade 12 candidates should have learnt about in class and through their textbooks. This 'basic content' should be familiar to them and is *unlikely* to pose any challenge to the envisaged Grade 12 candidate **(content)**.
- This question simply requires recognizing and remembering what a set method does and remembering the syntax to be used. **(task)**.
- Candidates only have to write one short method to obtain 2 marks. The mark allocation is straightforward **(expected response).**

This question is thus easy in regard to all four sources of difficulty in the framework

Memorandum/Marking guidelines

Mutator method for setVisitDate:
Method definition with date parameter✓
Assign the parameter value to the attribute ✓ (2)

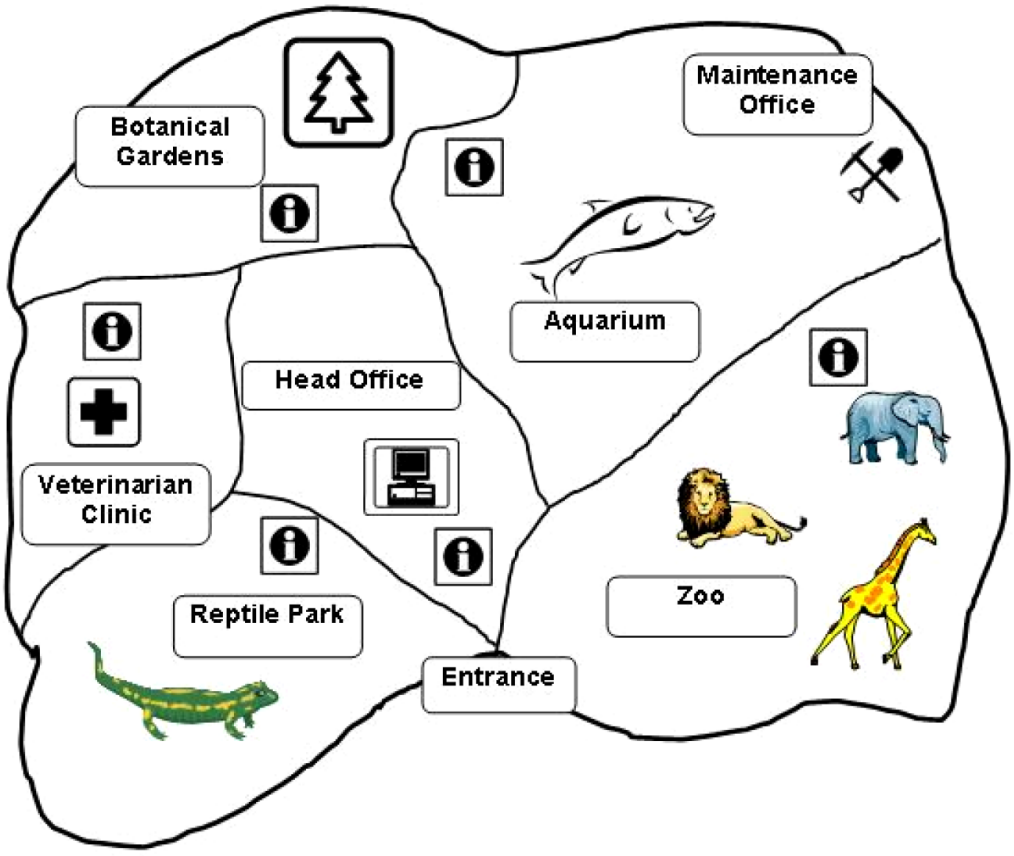
TABLE 8: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 2 – MODERATE

Example 1:

Question 2.1.2 (b), 2012, November Paper 2: **(Adapted)**

SCENARIO

The Red Feather Nature Park consists of various smaller parks, including a reptile park, an aquarium, a zoo and a botanical garden as indicated in the diagram below.



Each smaller park has its own administration offices with computers that are linked to a server at the head office. The head office is situated near the main entrance to the Park. Most of the administrative work is done here.

In a new project to serve the community, learners from various schools volunteer to work at the Red Feather Nature Park during their holidays. Some of the learners will work with the animals, feeding them, cleaning the cages, et cetera. Some of the learners will receive a short training course as guides. Your expertise as an IT learner is needed in a group that is assigned to Mr Eagle, the Park's administration manager. Your group will help solve hardware-, software- and network-related problems.

Your group will also assist with new technology that will be implemented where cellphones can be used during guided tours. The official website of the Park (www.redpark.co.za) also needs some attention.

The hard disk contains mostly photographs and is almost full. The new trend in hard drive storage devices is to increase the amount of data that can be stored in the same amount of space. Name TWO ways in which this can be achieved. (2)

Discussion:

This question is classified as 'moderately difficult' because:

- The instruction in this question is quite explicit; candidates need to 'name two ways'. However, the use of the word 'this' in the instruction, means that candidates have to infer what it is they have to achieve. They have to refer back to the opening statement and recognise that they have to provide a way of increasing the data that can be stored in the same amount of space. To understand the opening statement, they have to understand the term ''trend'; the envisaged Grade 12 candidate should be familiar with this term **(stimulus)**.
- This question assesses subject knowledge which forms part of the core curriculum for the grade, namely System Technologies (Computer Management) and specifically Data/File Compression which will include vertical/perpendicular recording. These concept/s involved are moderately difficult for the envisaged Grade 12 candidate to grasp **(content)**.
- To answer this question candidates first need to have an understanding of how data is stored on hard drives. Here they have to show their understanding of the physical arrangement of data on a hard drive and apply their understanding in an actual situation to identify two ways in which to achieve the goal of saving storage space. They need to recognise using vertical/perpendicular recording or using file compression is required. The content required does contribute to a moderate level of difficulty for the task. The task will require all of the above **(task)**.
- One mark is allocated for giving one way. The expected response is easy to write and mark **(expected response)**.

As the above discussion shows, this question is moderately difficult in relation to 1/2/3 sources of difficulty, namely stimulus, content, and task.

Memorandum/Marking guidelines

Any two methods:

- Reducing the size of the read/write heads/density of tracks. ✓
- Change the process of storing data e.g. using vertical/perpendicular recording. ✓
- Using file compression.✓

Example 2 – same scenario as Example 1 above

Question 2.1.2 (a), 2012, November Paper 2:

All of the photographs, except those taken by the lead photographer at the Park, must be deleted. Fortunately, metadata was set up. Give ONE example of metadata that is applicable to this situation. (1)

Discussion:

This question is classified as 'moderately difficult' because:

- The instruction in this question is quite explicit; candidates only need to 'give one example of metadata. The language used is well within the comprehension level of an envisaged grade 12 candidate **(stimulus)**.
- This question assesses subject knowledge which forms part of the core curriculum for the grade, namely Data and Information Management, specifically metadata. The candidate would need to know what data is first and then be able to understand metadata and therefore the concept involved is moderately difficult for the envisaged Grade 12 candidate to grasp **(content)**.
- Candidates only have to write one example of metadata; however, they need an understanding of metadata and need to apply it to this scenario. Therefore, the cognitive level could be regarding as applying knowledge and the difficulty level as moderately difficult **(task)**.
- One mark is allocated for giving one example. The expected response is easy to write and mark **(expected response)**.

As the above discussion shows, this question is moderately difficult in relation to 2 and 3, sources of difficulty, namely content and task.

Example 3 – Same scenario as Example 1 and Example 2

Question 2.2.4, 2012 November, Paper 2

Currently all the photographs, letters and other documents, such as financial reports and order forms, are saved in the root folder on the hard drive. Draw a simple diagram of a folder structure to illustrate an improved structure for organising the files on a hard drive. Make provision for at least TWO levels of subfolders. (2)

Discussion:

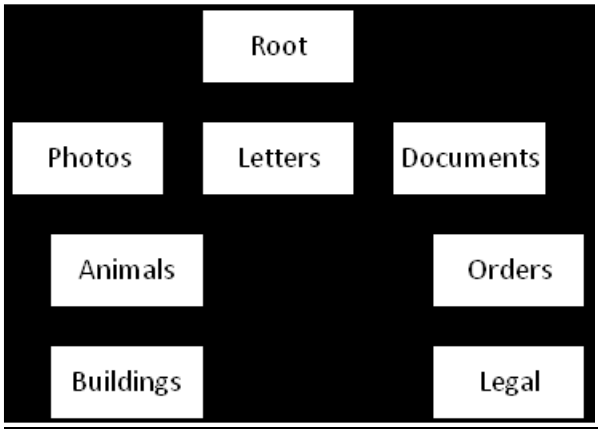
This question is classified as a 'moderately difficult' question because:

- The terminology, root folder, folder structure, subfolders are all subject specific. This question makes use of subject specific phraseology and terminology. Therefore, the question is considered moderately difficult **(stimulus)**.
- The knowledge required to answer this question is based on different concepts. Candidates would need to be familiar with directory structure, root folder, subfolders and what is considered as an ideal directory structure. There is more than one concept involved in this question and therefore would be considered moderately difficult for the envisaged Grade 12 candidate **(content)**.
- The task required here is for the candidate to draw a diagrammatic representation of a new improved directory structure. The cognitive demand for this question could be level 3 that is analysing and evaluating. However, the task is quite a straight forward task since any format/representation is acceptable **(task)**.

- The expected response is a diagrammatic representation of the new directory structure which must show at least 3 levels of file management. Candidates may represent this differently and therefore the marking could be problematic **(expected response)**.

Memorandum/Marking guidelines

Accept any correct labelled visual diagram of a file structure showing three levels of file management. ✓✓



Example 4 – Practical – Moderately difficult

Question 3.1: DBE, November 2016, IT Paper 1

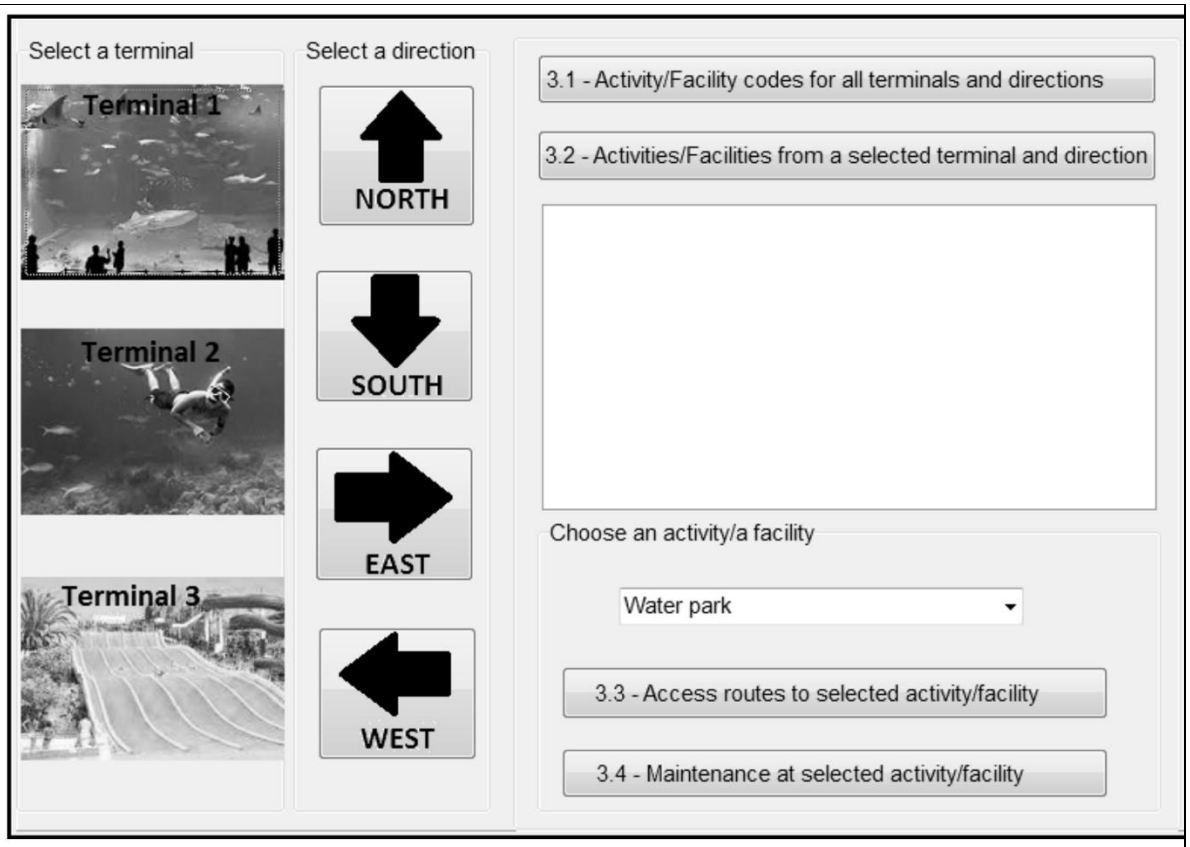
Synopsis of scenario on which question is based:
Aqua Wonderland is a water theme park that provides entertainment, access to restaurants, shopping, water slides and many more activities. The administrators of Aqua Wonderland are currently working on different techniques and strategies to improve the popularity of the park.

Information centres, referred to as 'terminals', have been set up at three different points along the routes in the park. The management requires a software program to provide information to visitors to locate the different activities and facilities at Aqua Wonderland and to be aware of maintenance activities in the park.

Do the following:

- Compile and execute the program in the **Question 3** folder. Currently, the program has no functionality.
- Complete the code for each question as described in QUESTION3.1 to ...

Supplied GUI
The supplied GUI represents a self-help interface to assist visitors in reaching various activities and facilities within the park.



Supplied data:

You are provided with two parallel arrays and one two-dimensional array.
arrActivities is a one-dimensional array that contains the names of activities and facilities in the park. The data stored in this array are as follows:
Water park, Aquarium, Sea, Restaurants, Shopping, Diving, Help desk, Penguin park, Shark tank, Dolphin shows.
A corresponding parallel array called **arrCodes** contains letters from the alphabet, each representing the corresponding activity/facility described in the **arrActivities** array.
The **arrCodes** array contains the following elements:
W, A, S, R, X, D, H, P, T, L
The first element (letter W) in the **arrCodes** array represents the first element ('Water park') in the **arrActivities** array, the second element (letter A) in the **arrCodes** array represents the second element ('Aquarium') in the **arrActivities** array, and so on.
arrActCodes is a two-dimensional array that contains a combination of codes that represent activities and facilities that are accessible from a specific terminal when the visitor departs in a specific direction. The codes contained in this array are as follows:

	North	South	East	West
Terminal 1	DXWAT	HRDST	STWLP	RDT
Terminal 2	SWA	SRXD	LWXH	SHA
Terminal 3	WLSR	AT	DATX	HW

NOTE: The row and column headings are not provided as part of the two-dimensional array.

Example:
The activity code that applies when a visitor walks from Terminal 1 in a northerly direction is DXWAT.
Using the content of the **arrCodes** and **arrActivities** arrays, it can be established that the activities and facilities that the code DXWAT refers to are Diving, Shopping, Water park, Aquarium and Shark tank.

NOTE:

- You are NOT allowed to modify supplied data manually. Code must be written to manipulate the supplied data according to the requirements.
- The use of good programming techniques and modular design must be applied in the design and coding of your solution.

Question:

3.1 Button [3.1 – Activity/Facility codes for all terminals and directions]
The program must display the content of the two-dimensional array **arrActCodes** neatly in rows and columns. Display the directions as column headings and the terminals as row labels.

Example of output:

	North	South	East	West
Terminal 1	DXWAT	HRDST	STWLP	RDT
Terminal 2	SWA	SRXD	LWXH	SHA
Terminal 3	WLSR	AT	DATX	HW

Discussion:

The question has both components that could be considered easy and other components as moderately difficult, therefore the question will be categorised as moderately difficult for the following reasons:

- The question is of reasonable length; however, it does make reading demands on candidates. The instruction is very clear. The terminology used should be familiar to all Grade 12 IT candidates **(stimulus)**.
- The question assesses subject knowledge that all Grade 12 candidates should have learnt about in class and through their textbooks. The concept

of reading from a two-dimensional array is quite simple and this should not pose any challenge to the envisaged Grade 12 candidate **(content)**.
- This question requires extracting data from a two-dimensional array as well as finding a way of including the labels for the rows and columns which is not part of the two-dimensional array **(task)**.
- Candidates have to write a fair amount of programming code; however, the code is not too complex **(expected response).**

This question is thus moderately difficult in regard to all four sources of difficulty in the framework.

Memorandum/Marking guidelines

Button [3.1 – Activity/Facility codes for all terminals and directions]
Display column headings✓
Outer loop to control the rows✓
Join terminal number to line✓
Inner loop to control the columns✓
Find correct data element in twoD array ✓
Join data from twoD array to line End inner loop Display the line in the output area on a new line ✓
End outer loop Display in neat columns✓
Use a data structure or any other way to find the directions North, South, East and West✓ **(9)**

TABLE 9: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 3 – DIFFICULT

Example 1:

Question 5.2.1, 2012 November Paper 2 –
A member of the panel has compiled a database called **PlantsDB** containing data of plants the Park needs to buy and nurseries supplying these plants. Various types of plants are required, such as trees, shrubs and creepers, et cetera. One of the tables in the database is the **tblNursery** table with the following layout:

tblNursery			
Key	**Field Name**	**Data Type**	**Description**
🔑	CatalogueNumber	Text	Unique number
	BotanicalName	Text	Botanical name of the plant
	GeneralName	Text	Name of the plant
	PoisonousToAnimals	Number	Is the plant poisonous to animals?
	FertiliserType	Text	Type of fertiliser suitable for the plant
	FertiliserCost	Text	Cost of the fertiliser
	Nursery	Text	Name of the nursery supplying the plant
	NurseryPhoneNumber	Number	Contact number of the nursery supplying the plant
	NurseryContactPerson	Text	Name of the contact person at the nursery supplying the plant

Another table **tlbTreeOrders** is used to store data on the orders placed for trees. The table has not been normalised.

tblTreeOrders			
Key	**Field Name**	**Data Type**	**Description**
	OrderNo	Text	Number of the order
🔑	OrderDate	Date/Time	Date the order was placed
	Tree1	Text	Name of the tree
	Description1	Text	Description of the tree
	Quantity1	Number	Quantity of the trees that were ordered
	CostPrice1	Currency	Cost price of the tree
	Tree2	Text	Name of the tree
	Description2	Text	Description of the tree
	Quantity2	Number	Quantity of the trees that were ordered
	CostPrice2	Currency	Cost price of the tree
	TotalAmount	Currency	Total monetary value of this order

Insert anomalies is one of the problems that can occur when the table has not been normalised. The following orders are placed separately but on the same day. In each case, give a reason why the insert anomaly will occur when the data has to be captured in the **tblTreeOrders** table.

(a) In the morning, the manager orders three different kinds of trees using order number AB230. (2)

(b) In the afternoon, another two trees need to be ordered using order number AB245. (2)

Discussion:

This question is classified as a 'difficult' question because:

- The demands involved in' unravelling' this question and source material are high. There is significant amount of reading involved in this question. The terminology, insert anomalies, that is used is not considered common knowledge. This question makes use of subject specific phraseology and

terminology. There is also significant amount of reading in this question since the scenario together with all the database tables must be read and understood in order to answer this question. Therefore, the question is considered difficult **(stimulus)**.

- To answer the question candidates have to understand the term insert anomalies. They have to figure out that the table, tblTreeOrders, does not provide for more than two different types of trees to be bought per order; and with the field, Order Date, as primary key, only one order can be placed per day. All of this must be analysed to determine the correct answer **(task)**.
- The knowledge, namely normalisation that candidates must draw on to answer this question is considered difficult. For the envisaged Grade 12 candidate to understand normalisation it does pose some challenge **(content)**.
- The marks allocated are just 2 for each sub-question and it would be quite easy to mark. If the candidate is able to correctly analyse the question then the expected response will be quite straight forward to record **(expected response)**.

Memorandum/Marking guidelines

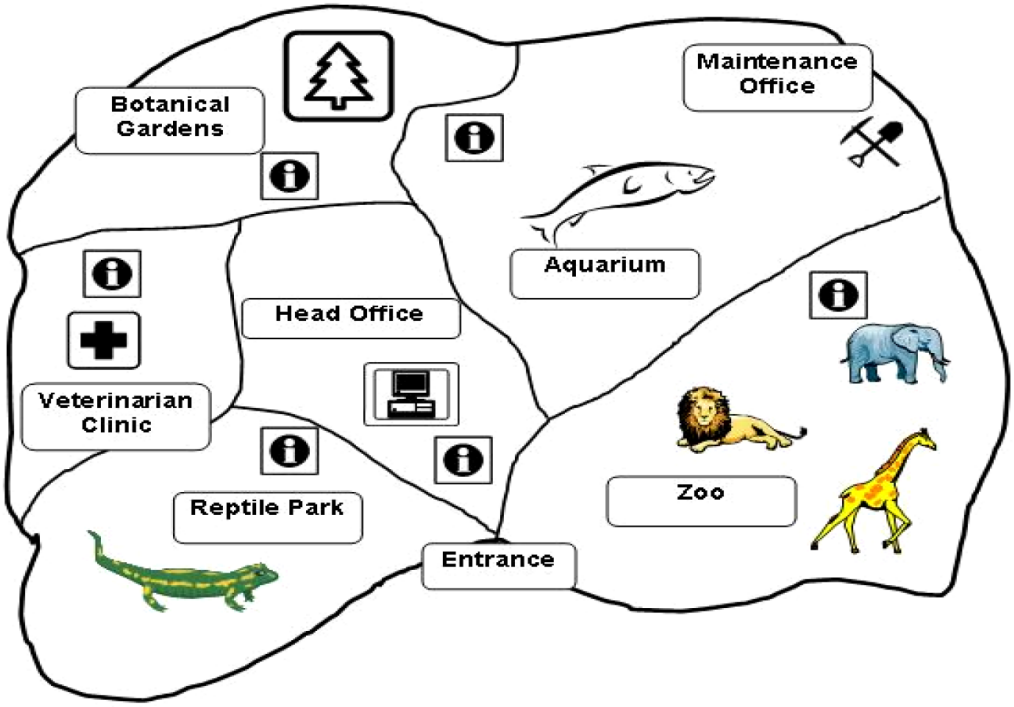
(a) The table doesn't provide for more than two different types of trees to be bought per order. (2)

(b) With the field OrderDate as primary key, only one record with a certain date is allowed in the table. It means you are only allowed one order for a certain date.

Example 2:

SCENARIO

The Red Feather Nature Park consists of various smaller parks, including a reptile park, an aquarium, a zoo and a botanical garden as indicated in the diagram below.



Each smaller park has its own administration offices with computers that are linked to a server at the head office. The head office is situated near the main entrance to the Park. Most of the administrative work is done here.

In a new project to serve the community, learners from various schools volunteer to work at the Red Feather Nature Park during their holidays. Some of the learners will work with the animals, feeding them, cleaning the cages, et cetera. Some of the learners will receive a short training course as guides. Your expertise as an IT learner is needed in a group that is assigned to Mr Eagle, the Park's administration manager. Your group will help solve hardware-, software- and network-related problems.

Your group will also assist with new technology that will be implemented where cellphones can be used during guided tours. The official website of the Park (www.redpark.co.za) also needs some attention.

Question 2.7.2, 2012, November Paper 2:

Give TWO practical examples of how GPS technology can be used at the park other than conducting GPS tours. (2)

Discussion:

This question is classified as 'difficult' because:

- The candidate is expected to do a lot of reading to fully understand the scenario provided. The demands involved in' unravelling' this question and source material are high. This question makes use of subject specific phraseology and terminology, namely, GPS tours. This may be the first time

some candidates come across the term "GPS Tours". Therefore, the question is considered difficult **(stimulus)**.

- The knowledge required to answer this question is based on different concepts. Candidates would need to be familiar with satellite and microwave technology as well as GPS technology and its uses. There is more than one concept involved in this question and therefore would be considered difficult for the envisaged Grade 12 candidate **(content)**.
- To answer the question candidates have to understand the concepts of GPS technology, together with satellite technology and or Microwave technology. Candidates would need to engage in inferential reasoning by thinking of other examples of uses of GPS technology that would apply to this scenario. All of this must be analysed to determine the correct answer **(task)**.
- Only 2 practical examples are required but the candidate would need to give a response well-worded and meaningful to the scenario concerned. Marking can become a problem since some examples may lend themselves to subjective marking. The envisaged grade 12 candidate may find it difficult to obtain full 2 marks **(expected response).**

Memorandum/Marking guidelines

Any two valid examples:

- Guiding someone to a specific animal enclosure. ✓
- Give the visitor information about the layout of the park. ✓
- Together with audio feed it can give you information about animals at a specific location. ✓
- Using satellite technology (GPS), audio and/or multimedia content is triggered based on a user's location in the park. ✓ (2)

Example 3 – Same scenario as Example 2 above

Question 2.1.3 (b) (ii), 2012, November Paper 2: - **(Adapted)**

Some of the learners in the group are of the opinion that, if there was enough virtual memory, there is no need to upgrade the RAM. Explain why virtual memory will not be the solution to better performance. (2)

Discussion:

This question is classified as 'difficult' because:

- The instruction in this question is quite clear. Candidates need to explain why virtual memory will not be a solution. The language used is well within the comprehension level of an envisaged Grade 12 candidate. The scenario will be one that they have encountered previously in their Practical assessment task (PAT) **(stimulus)**.
- This question assesses subject knowledge which forms part of the core curriculum for the grade, namely Hardware and Software. However, candidate would need to know what RAM is and what virtual memory is. The candidate will also need to know what factors that affect system

performance and this can be considered as difficult for the envisaged Grade 12 candidate to grasp **(content)**.

- To answer this question candidates have to apply their understanding of RAM as well as the concepts virtual memory and factors that enhance system performance to this scenario. They have to demonstrate an understanding of virtual memory and RAM in relation to better computer performance. The question can be considered as difficult because of the task involved **(task)**.
- Two marks is allocated for giving an explanation as to why virtual memory will not be a solution. The expected response is easy to write and mark **(expected response)**.

As the discussion shows, this question is difficult in relation to 2 and 3 sources of difficulty, namely, content and task.

Memorandum/Marking guidelines

Any ONE fact why virtual memory isn't the solution.

- Virtual memory is slow/using hard disk space as memory slows down the performance. ✓ ✓
- Thrashing may occur. ✓ ✓
- To be effective the need for a large amount of secondary storage (hard disk space) arises. ✓ ✓ (2)

Example 4 – Practical:

Question 3.3: DBE, November 2016, IT Paper 1

Synopsis of scenario on which question is based:

SCENARIO

Aqua Wonderland is a water theme park that provides entertainment, access to restaurants, shopping, water slides and many more activities. The administrators of Aqua Wonderland are currently working on different techniques and strategies to improve the popularity of the park.

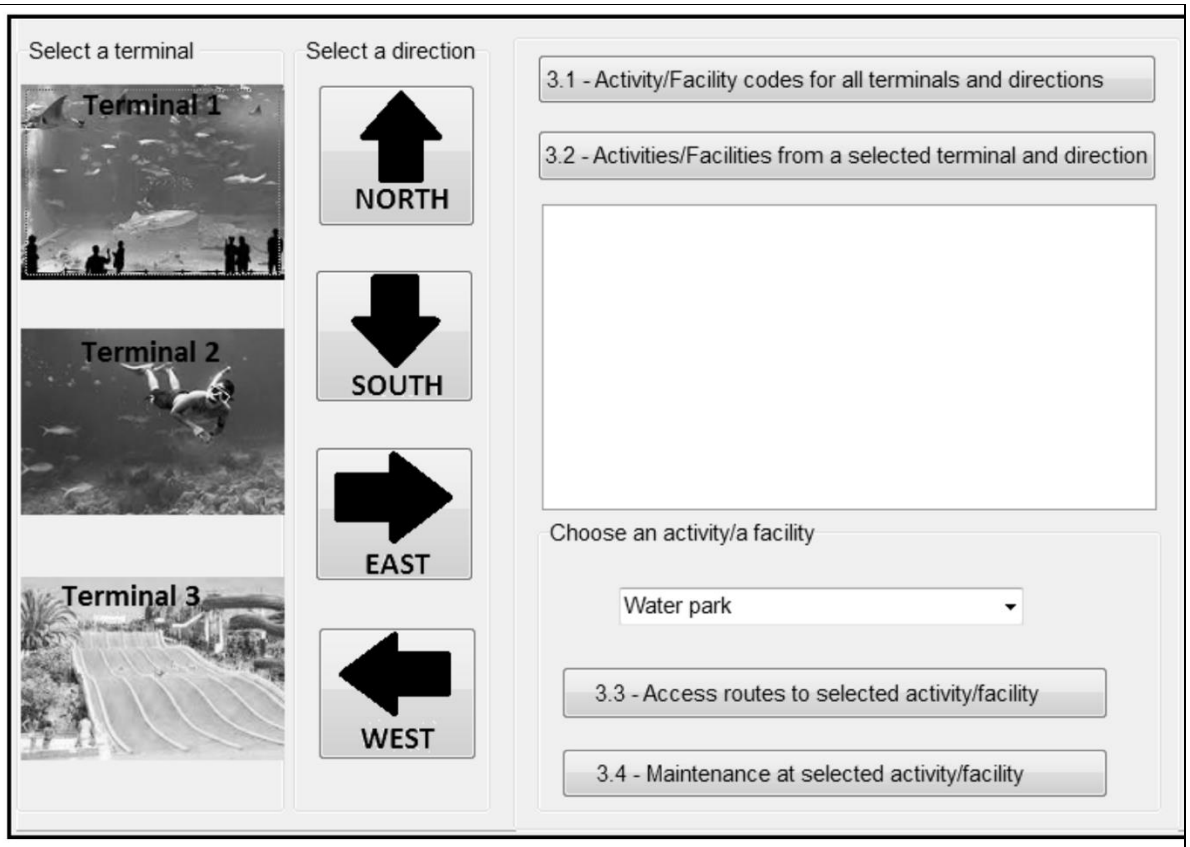
Information centres, referred to as 'terminals', have been set up at three different points along the routes in the park. The management requires a software program to provide information to visitors to locate the different activities and facilities at Aqua Wonderland and to be aware of maintenance activities in the park.

Do the following:

- Compile and execute the program in the **Question3** folder. Currently, the program has no functionality.
- Complete the code for each question as described in QUESTION3.1 to ...

Supplied GUI

The supplied GUI represents a self-help interface to assist visitors in reaching various activities and facilities within the park.



Supplied data:

You are provided with two parallel arrays and one two-dimensional array.
arrActivities is a one-dimensional array that contains the names of activities and facilities in the park. The data stored in this array are as follows:
Water park, Aquarium, Sea, Restaurants, Shopping, Diving, Help desk, Penguin park, Shark tank, Dolphin shows.

A corresponding parallel array called **arrCodes** contains letters from the alphabet, each representing the corresponding activity/facility described in the **arrActivities** array.

The **arrCodes** array contains the following elements:
W, A, S, R, X, D, H, P, T, L

The first element (letter W) in the **arrCodes** array represents the first element ('Water park') in the **arrActivities** array, the second element (letter A) in the **arrCodes** array represents the second element ('Aquarium') in the **arrActivities** array, and so on.

arrActCodes is a two-dimensional array that contains a combination of codes that represent activities and facilities that are accessible from a specific terminal when the visitor departs in a specific direction. The codes contained in this array are as follows:

	North	South	East	West
Terminal 1	DXWAT	HRDST	STWLP	RDT
Terminal 2	SWA	SRXD	LWXH	SHA
Terminal 3	WLSR	AT	DATX	HW

NOTE: The row and column headings are not provided as part of the two-dimensional array.

Example:
The activity code that applies when a visitor walks from Terminal 1 in a northerly direction is DXWAT.

Using the content of the **arrCodes** and **arrActivities** arrays, it can be established that the activities and facilities that the code DXWAT refers to are Diving, Shopping, Water park, Aquarium and Shark tank.

NOTE:

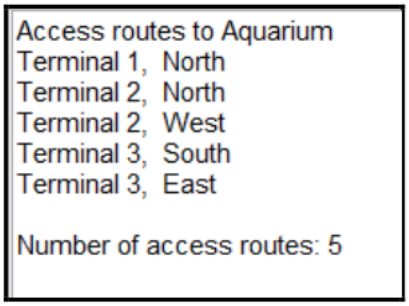
- You are NOT allowed to modify supplied data manually. Code must be written to manipulate the supplied data according to the requirements.
- The use of good programming techniques and modular design must be applied in the design and coding of your solution.

Question:
3.3 Button [3.3 – Access routes to selected activity/facility]

Once the user selects a specific activity/facility from the combo box provided, the user must be able to view all access routes to that specific activity/facility. Display the terminal number and the direction for each access route for the visitor to be able to reach the activity/facility selected.

The total number of access routes leading to the activity selected must be determined and displayed.

Example of output if Aquarium was selected from the combo box:



(10)

Discussion:
The question has components that could be considered easy, moderately difficult as well as difficult, and the question has a fair amount of problem solving. If the

problem is not solved the learner will not be able to write appropriate code for the solution. The question is considered difficult:

- The question is of reasonable length, however, there is a fair amount of reading required to understand the problem and therefore does make reading demands on candidates **(stimulus)**.
- The question assesses subject knowledge that all Grade 12 candidates should have learnt about in class and through their textbooks. The concept of two dimensional arrays is quite simple and this should not pose any challenge to the envisaged Grade 12 candidate, however, when placed together with a problem to solve it can pose some difficulty **(content)**.
- This question requires problem solving in order to proceed with any meaningful coding. A fair amount of code is required to provide the solution to the problem **(task)**.
- Candidates have to write a fair amount of programming code in order to solve the problem **(expected response)**.

This question is thus difficult in regard to all four sources of difficulty in the framework.

Memo
Extract index of the activity/facility selected in the combo box✓
Set counter to 0.✓
Display heading.✓
Find the code of selected activity✓
Outer loop for rows. ✓ Inner loop for columns. ✓
Test if the code of the selected activity is a part of the code in the twoD array. ✓
Display the terminal number and the direction✓
Increase counter by 1. ✓
Display the label for the number of activities and the value of counter. ✓
(10)

TABLE 10: EXAMPLES OF QUESTIONS AT DIFFICULTY LEVEL 4 – VERY DIFFICULT

Note:
During the development of the exemplar book some subject specialist argued that there is a faint line between a difficult and a very difficult question. It was also evident that in some subjects question papers did not have questions that could be categorised as very difficult. In order to cater for this category, subject specialists were requested to adapt existing questions and make them very difficult or create their own examples of very difficult question. However, it was noted that in some instances attempts to create very difficult questions introduced invalid sources of difficulty which in turn rendered the questions invalid. Hence Umalusi acknowledges that the very difficult category may be problematic and therefore requires especially careful scrutiny.

Example 1:

Question

Question 6.2.3, 2011 November Paper 2

The use of computers for criminal intent is on the increase. The terms below are used to describe people that are a threat to computer systems.

For each term:

- Cyber terrorist (2)
- Cyber extortionist (2)
- Script kiddie (2)
- Wardriver (2)

(a) Explain the term. What is it?

(b) Give a brief description of how such a person can cause damage to another person.

Discussion:

This question is classified as very difficult because:

- The question incorporates the use of sophisticated subject specific phraseology and terminology such as cyber terrorist, cyber extortionist, script kiddie and Wardriver. The use of the words "criminal intent" is also challenging for candidates since they may not have encounters these terms and will not be able to relate them to criminal activities **(stimulus)**.
- This question assesses 'advanced content' for the grade level, and is likely to be very difficult for the envisaged Grade 12 candidate. Answering the question requires knowledge of extremely abstract constructs / concepts, namely, cyber terrorist, cyber extortionist, script kiddie and Wardriver. For candidates to answer the question successfully they would have had to have done extensive reading on their own and be avid internet users **(content)**.
- To answer the question candidates have to understand the concepts of cybercrime and computer security. Not only are candidates required to say what each person is but to also think of an example of how that particular cybercriminal can affect another person's computer **(task)**.
- Each response is just awarded two marks, one for explaining what the person is and another for the example given. The expected response and marking should not pose any difficulty **(expected response)**.

As the above discussion shows, this question is very difficult in relation to 1, 2 and 3 sources of difficulty, namely, stimulus, content and task.

Memorandum/Marking guidelines

Cyber terrorist

(a) Someone who uses the Internet/network to destroy or damage computers for political / religious reasons.
(b) The extensive damage might destroy a nation's air-traffic control system, electricity-generating companies or a telecommunications infrastructure. (2)

Cyber extortionist

(a) Someone who uses e-mail as a vehicle for extortion.

(b) These perpetrators send a company a threatening e-mail message indicating they will expose confidential information, exploit a security flaw, or launch an attack that will compromise the company's network if they are not paid a sum of money. (2)

Script kiddie

(a) Has the same intent as a cracker but does not have the technical skills and knowledge.

(b) Script kiddies are often teenagers who use prewritten hacking and cracking programs to break into computers. (2)

Wardriver

(a) Intrusion technique in which an individual attempt to detect wireless networks via their mobile devices while driving a vehicle through areas they suspect have a wireless network.
(b) The damage caused to other people range from using Internet data cap to having access to confidential material. (2)

Example 2:

Question 6.3.3, 2011, November Paper 2

Bootlegging is one of the main categories of piracy.
(a) Explain the term *bootlegging.* (1)
(b) Give ONE example of a bootleg. (1)

Discussion:

This question is classified as very difficult because:

- The question incorporates the use of very sophisticated subject specific phraseology and terminology that is bootlegging **(stimulus)**.
- This question assesses 'advanced content' for the grade level, and is likely to be very difficult for the envisaged Grade 12 candidate. Answering the question requires knowledge of extremely abstract constructs / concepts, namely, bootlegging and piracy. For candidates to answer the question successfully they would have had to have done extensive reading on their own and be avid internet users **(content)**.

- To answer the question candidates have to understand the concepts of piracy and the different forms of piracy. Not only are candidates required to say what bootlegging is but to also think of an example as well. The cognitive demand for this question would be level 3 that is analysing, evaluating and critical **(task)**.
- Each response is just awarded a mark, one for explaining what bootlegging is and another for the example given. The expected response and marking should not pose any difficulty (**expected response)**.

As the discussion shows, this question is very difficult in relation to 1, 2 and 3 sources of difficulty, namely, stimulus, content and task

Memorandum/Marking guidelines

(a) Bootlegging is the process of illegally recording a live event /broadcast and then selling this recording without obtaining the copyright holder's permission. ✓ (1)

(b) (Any valid example).

- Filming a movie while it is being shown in a cinema.✓
- Video-taping a live concert that you attend and then selling the video. (1)

Example 4 – Practical - Very difficult

DBE, November 2016, IT Paper 1, Question 3.4

Synopsis of scenario on which question is based:

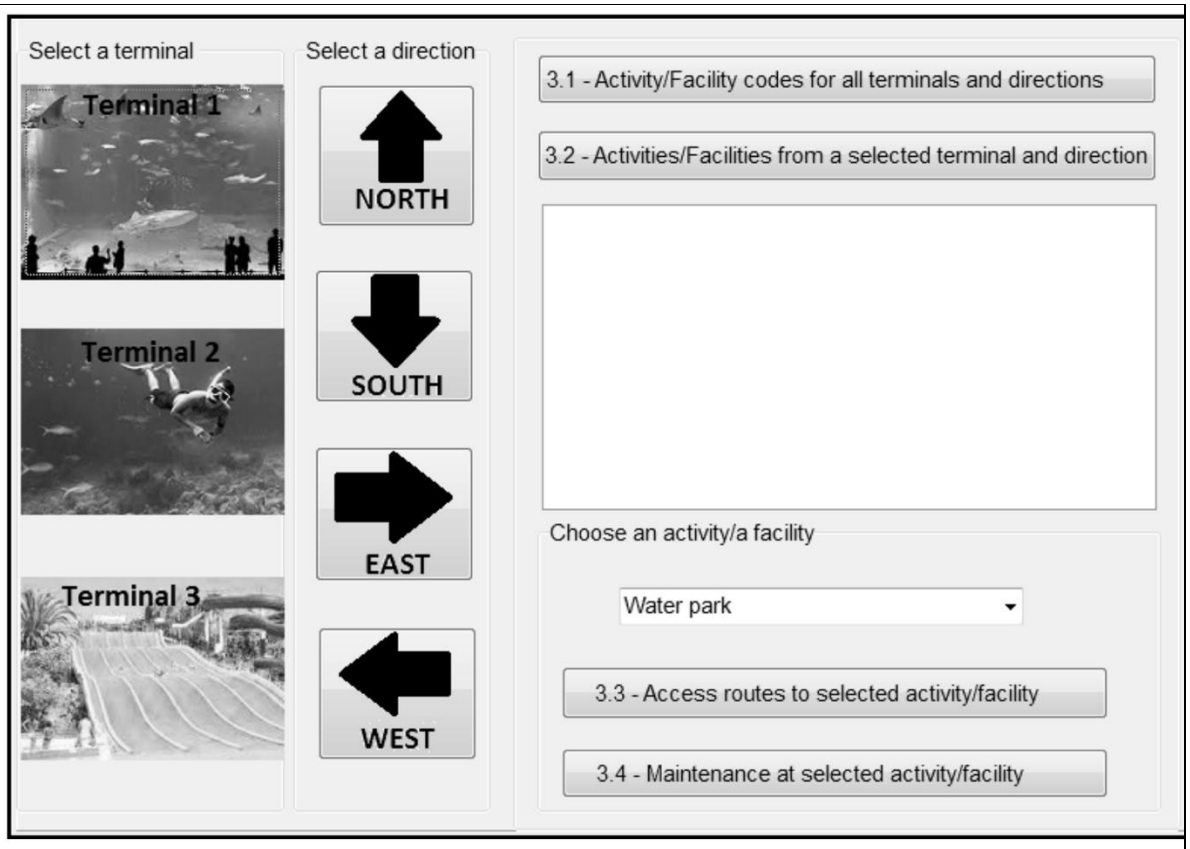
Information centres, referred to as 'terminals', have been set up at three different points along the routes in the park. The management requires a software program to provide information to visitors to locate the different activities and facilities at Aqua Wonderland and to be aware of maintenance activities in the park.

Do the following:

- Compile and execute the program in the **Question3** folder. Currently, the program has no functionality.
- Complete the code for each question as described in QUESTION3.1 to ...

Supplied GUI

The supplied GUI represents a self-help interface to assist visitors in reaching various activities and facilities within the park.



Supplied data:

You are provided with two parallel arrays and one two-dimensional array.

arrActivities is a one-dimensional array that contains the names of activities and facilities in the park. The data stored in this array are as follows:

Water park, Aquarium, Sea, Restaurants, Shopping, Diving, Help desk, Penguin park, Shark tank, Dolphin shows

A corresponding parallel array called **arrCodes** contains letters from the alphabet, each representing the corresponding activity/facility described in the **arrActivities** array.

The **arrCodes** array contains the following elements:

W, A, S, R, X, D, H, P, T, L

The first element (letter W) in the **arrCodes** array represents the first element ('Water park') in the **arrActivities** array, the second element (letter A) in the **arrCodes** array represents the second element ('Aquarium') in the **arrActivities** array, and so on.

arrActCodes is a two-dimensional array that contains a combination of codes that represent activities and facilities that are accessible from a specific terminal when the visitor departs in a specific direction. The codes contained in this array are as follows:

	North	South	East	West
Terminal 1	DXWAT	HRDST	STWLP	RDT
Terminal 2	SWA	SRXD	LWXH	SHA
Terminal 3	WLSR	AT	DATX	HW

NOTE: The row and column headings are not provided as part of the two-dimensional array.

Example:

The activity code that applies when a visitor walks from Terminal 1 in a northerly direction is DXWAT.

Using the content of the **arrCodes** and **arrActivities** arrays, it can be established that the activities and facilities that the code DXWAT refers to are Diving, Shopping, Water park, Aquarium and Shark tank.

NOTE:

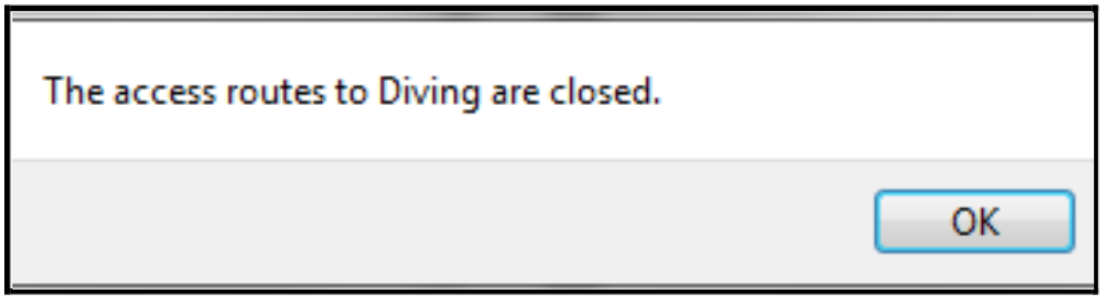
- You are NOT allowed to modify supplied data manually. Code must be written to manipulate the supplied data according to the requirements.
- The use of good programming techniques and modular design must be applied in the design and coding of your solution.

Question:

3.4 Button [3.4 – Maintenance at selected activity/facility]

The area where activities take place or facilities are provided may sometimes be closed due to maintenance. The user must select an activity/facility where maintenance must take place from the combo box provided. The program must remove all references to the selected activity/facility from the two-dimensional array and display a suitable message in a dialog box indicating that the information has been updated. The updated content of the two-dimensional array must be displayed in the output area. (8)

Example of output if Diving was selected from the combo box:



Example of output after removing the letter D from the two-dimensional array **arrActCodes** due to maintenance that must be done on the diving facility:

Updated information:

	North	South	East	West
Terminal 1	XWAT	HRST	STWLP	RT
Terminal 2	SWA	SRX	LWXH	SHA
Terminal 3	WLSR	AT	ATX	HW

Discussion:

The question has components that could be considered easy, moderately difficult, difficult and very difficult. The question has a fair amount of problem solving and if the problem is not solved the learner will not be able to write appropriate code. The question is considered very difficult:

- The question requires a lot of reading with understanding and therefore does make reading demands on candidates **(stimulus)**.
- The question assesses subject knowledge that all Grade 12 candidates should have learnt about in class and through their textbooks. The concept of two dimensional arrays is quite simple and this should not pose any challenge to the envisaged Grade 12 candidate, however, when placed together with a problem to solve it can pose some difficulty. This question is also assessing a candidates knowledge on deleting from a two-dimensional array and correctly updating the array **(content)**.
- This question requires problem solving in order to proceed with any meaningful coding. A fair amount of code is required to provide the solution to the problem **(task)**.
- Candidates have to write a fair amount of programming code in order to solve the problem **(expected response)**.

This question is thus very difficult in regard to all four sources of difficulty in the framework.

Memorandum/Marking guidelines

Button [3.4 – Maintenance at a selected activity/facility].

Extract index of the activity/facility selected in the combo box. ✓

Outer loop for rows. ✓

Inner loop for columns. ✓

Check if the code of the activity/facility selected in the combo box is a part of the code in the twoD array. ✓

Delete the code letter from the twoD array✓ at correct row and correct column. ✓

Display a message indicating the access routes to the selected activity/facility is closed. ✓

Call a method to display the updated twoD array with headings. ✓ (8)

9. Concluding remarks

This exemplar book is intended to be used as a training tool to ensure that all role players in the Information Technology Examination are working from a common set of principles, concepts, tools and frameworks for assessing cognitive challenge when examinations are set, moderated and evaluated. We hope that the discussion provided and the examples of questions shown by level and type of cognitive demand and later by level of difficulty assist users of the exemplar book to achieve this goal.

Reference list

Ahmed, A., and Pollitt, A. (1999). Curriculum demands and question difficulty. Paper presented at IAEA Conference, Slovenia.

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing.* Washington, DC: Author.

Bloom. B. S., Engelhart, M. D., Furst, R. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook 1: Cognitive domain.* New York: David McKay.

Bloom, B. S., Hastings, J. T., & Madaus, G. F. (1971). Handbook on formative and summative evaluation of student learning. New York: McGraw-Hill Book Company.

Crowe, A.A. (2012). *Standards of South African Senior Certificate Biology Examinations: 1994 to 2007.* Doctoral dissertation, University of Cape Town, Cape Town, South Africa.

Department of Basic Education(DBE): (2012) Information Technology Examination Paper 2; V1, DBE, 2012.

Department of Basic Education (DBE): (2011) Information Technology Examination Paper 2; V1, DBE.