City & Guilds

A City & Guilds Group Business

5220-32-035/535 Level 3 Advanced Technical Extended Diploma in Digital Technologies (720) (Application Development) – Theory Exam (2)

Exam date: March 2019

Q1	State **four** 'system constraints' that need to be considered when analysing end-user needs.			
	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**
	1 mark each for any of the following, to a maximum of 4 marks: • hardware (1) • software (1) • in-house (1) • web/cloud (1)	The list contains system constraints. The candidate may give specific examples of constraints that are not included in the unit, such as: • skills - needed to use hardware and software • training - for using hardware and software • experience - of using hardware and software • budget - needed to buy hardware and software Where an item is duplicated within the answers given, either by name or meaning, the duplicated item will not be awarded a mark. Marks are capped to a maximum of 1 mark for each valid item stated.	**4**	**5220-035 310.1.1**
AO	AO1			
LO	310.1 Create program specifications			

Q2	Explain why the following project constraints must be considered when planning a software application. • Budget. • Time. • Specialist skills.			
	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**
	2 marks each for any of the following, to a maximum of 6 marks: • Budget is important because the client will have a need to control the amount to be paid for development (1) and the developer must ensure that the processes can be completed without exceeding the limit (1). • Time available must be considered because the client may need the completed application within a set deadline (1) and the developer must manage the project to comply with the limits set (1). • Specialist skills are important because the application development may need skills beyond the available skill set of the developer or team (1) and the owner/project manager must arrange the availability of the required skills through engagement of specialist developers (1) such as freelance developers.	Candidates may give very different explanations from those in the model answers, but the answers must be technically accurate. Where a candidate may give answers with constraints from a client or developer perspective they should be awarded the marks. Marks awarded are capped for each separate explanation at a total of 2 marks. Candidates should be allowed to give any valid explanation and marks should be awarded for each distinct element in the explanation. Where a point is duplicated within each explanation, by meaning, the duplicated item will not be awarded a mark.	**6**	**5220-035 310.1.1**
AO	AO2			
LO	310.1 Create program specifications			

<table>
<tr><td>Q3</td><td colspan="4">Explain how the following analytical tools can be used in gathering user requirements for the specification of a software application project.

• Interview.
• Direct questioning.
• Market research.</td></tr>
<tr><td></td><td>Acceptable answer(s)</td><td>Guidance</td><td>Max marks</td><td>Ref</td></tr>
<tr><td></td><td>2 marks for each explanation, to a maximum of 6 marks:
• Interviews can be used to gather a broad range of information from the client and the end-users (1). Interviews allow the interviewees to express fact and opinion (1) because the conversation can be flexible.
• Direct questioning can allow the interviewer to gather specific information (1) from particular people/types of people (1).
• Market research can be used to gather information about the need for a product from potential users (1) and to assess the availability of other products (1) used to perform similar processes.</td><td>Candidates may give very different explanations from those in the model answers, but the answers must be technically accurate.

Marks awarded are capped for each separate explanation at a total of 2 marks.

Candidates should be allowed to give any valid explanation and marks should be awarded for each distinct element in the explanation.

Where a point is duplicated within each explanation, by meaning, the duplicated item will not be awarded a mark.</td><td>6</td><td>5220-035 310.1.1</td></tr>
<tr><td>AO</td><td colspan="4">AO2</td></tr>
<tr><td>LO</td><td colspan="4">310.1 Create program specifications</td></tr>
</table>

Q4	State **three** items that can be included in the requirements document for a software application project.			
	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**
	1 mark each for any of the following, to a maximum of 3 marks: • Overview of project aims (1) • Design specification (1) • Project management (1)	The list contains items included in a requirements document. The candidate may give specific examples of items that are not included in the unit, such as: • GUI/screen designs • database designs • data and class diagrams • Gantt charts • budget Where an item is duplicated within the answers given, either by name or meaning, the duplicated item will not be awarded a mark. Marks are capped to a maximum of 1 mark for each valid item stated.	**3**	**5220-035 310.1.3**
AO	AO1			
LO	310.1 Create program specifications			

<table>
<tr><td>Q5</td><td colspan="4">Explain an appropriate type of software application development project where each of the following system lifecycle models can be used.
Waterfall.
Rapid Application Development (RAD).
Agile.</td></tr>
<tr><td></td><td>Acceptable answer(s)</td><td>Guidance</td><td>Max marks</td><td>Ref</td></tr>
<tr><td></td><td>2 marks each for any of the following, to a maximum of 6 marks:
The waterfall model is appropriate for small projects (1) where each phase of the project can be completely defined in advance (1).
The Rapid Application Development (RAD) model is appropriate in projects where it is possible to use multiple developers with different skills (1) completing different processes at the same time (1) so that development time is reduced.
The Agile model is appropriate for projects where early versions of an application can be released (1) and features added incrementally with each release (1).</td><td>Candidates may give very different explanations from those in the model answers, but the answers must be technically accurate and explain a project type.

Marks awarded are capped for each separate explanation at a total of 2 marks.

Candidates should be allowed to give any valid explanation and marks should be awarded for each distinct element in the explanation.

Where a point is duplicated within each explanation, by meaning, the duplicated item will not be awarded a mark.</td><td>6</td><td>5220-035 310.1.2</td></tr>
<tr><td>AO</td><td colspan="4">AO2</td></tr>
<tr><td>LO</td><td colspan="4">310.1 Create program specifications</td></tr>
</table>

Q6	State the **three** fundamental data types used in application software development.			
	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**
	1 mark each for any of the following, to a maximum of 3 marks: • Numeric (1) • Alphanumeric (1) • Boolean (1)	The list contains the fundamental data types. The candidate may give names of implemented types when used as variables, such as: • Float • Integer • Decimal • String • Char The use of true/false or yes/no is not acceptable for the Boolean type. Where a type is duplicated within the answers given, either by name or meaning, the duplicated item will not be awarded a mark. Marks are capped to a maximum of 1 mark for each valid item stated.	**3**	**5220-035 310.2.1**
AO	AO1			
LO	310.2 Create design specifications			

<table>
<tr><td>Q7</td><td colspan="4">Explain how each of the following are used to hold data in application programming.

• Array.
• Stack.
• Queue.</td></tr>
<tr><td></td><td>Acceptable answer(s)</td><td>Guidance</td><td>Max marks</td><td>Ref</td></tr>
<tr><td></td><td>2 marks for each explanation, to a maximum of 6 marks:
• An <u>array</u> is used to define a space in memory (1) which will hold multiple data values of a similar type (1).
• In a <u>stack</u> data values are added to the structure up to a defined size (1) and removed using the rule ‘Last In First Out’ (LIFO) (1).
• In a <u>queue</u> data values are added to the structure up to a defined size (1) and removed using the rule ‘First In First Out’ (FIFO) (1).</td><td>Candidates may give very different explanations from those in the model answers, but the answers must be technically accurate.
For example, candidates may say that array values will be of the same type.
The candidates do not have to specifically use the acronyms ‘LIFO’ and ‘FIFO’ and they may use other acronyms representing the same concept.

Candidates may explain the operations for adding and removing items from stacks and queues which are called ‘push’ and ‘pop’ operations. Marks should be awarded for these explanations.

Marks awarded are capped for each separate explanation at a total of 2 marks.

Candidates should be allowed to give any valid explanation and marks should be awarded for each distinct element in the explanation.

Where a point is duplicated within each explanation, by meaning, the duplicated item will not be awarded a mark.</td><td>6</td><td>5220-035 310.2.1</td></tr>
<tr><td>AO</td><td colspan="4">AO2</td></tr>
<tr><td>LO</td><td colspan="4">310.2 Create design specifications</td></tr>
</table>

Q8	Explain how the following decision constructs are used in software programming. • Conditional check. • Conditional statement. • Switch statement.			
	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**
	2 marks for each explanation, to a maximum of 6 marks: • conditional checks are used in programming to compare two items against each other (1) and the outcome is evaluated to a Boolean value (1), eg true or false • conditional statements are used in programming to control the flow of execution of a program (1) based on the outcome of a conditional check (1) eg if (a > b) then do x. • switch statements are used in programming to check an input variable (1) against a defined range of possible values (1) to determine flow of execution.	Candidates may give very different explanations from those in the model answers, but the answers must be technically accurate. The explanations provided must make it clear that the candidate recognises the differences between conditional checks and conditional statements as the two are often confused with each other. Marks awarded are capped for each separate explanation at a total of 2 marks. Candidates should be allowed to give any valid explanation and marks should be awarded for each distinct element in the explanation. Where a point is duplicated within each explanation, by meaning, the duplicated item will not be awarded a mark.	**6**	**5220-035 310.2.2**
AO	AO2			
LO	310.2 Create design specifications			

Q9	Explain one benefit of using **each** of the following in object oriented programming. • Encapsulation. • Inheritance. • Polymorphism.			
	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**
	2 mark each for any of the following, to a maximum of 6 marks: • A benefit of using Encapsulation is that it allows the members of a class to be protected (1) from unauthorised alteration by external processes (1). • A benefit of using Inheritance is that it allows for code efficiency (1) because of the re-use of members in child classes (1) inherited from a parent. • A benefit of using Polymorphism is that it allows a single interface to be used (1) to address different implementations (1) through overloading.	Candidates may give very different explanations from those in the model answers, but the answers must be technically accurate. Marks awarded are capped for each separate explanation at a total of 2 marks. Candidates should be allowed to give any valid explanation and marks should be awarded for each distinct element in the explanation. Where a point is duplicated within each explanation, by meaning, the duplicated item will not be awarded a mark.	**6**	**5220-035 310.2.2**
AO	AO2			
LO	310.2 Create design specifications			

<table>
<tr><td>Q10</td><td colspan="4">State four items that can be included in the technical documentation for a software program.</td></tr>
<tr><td></td><td>Acceptable answer(s)</td><td>Guidance</td><td>Max marks</td><td>Ref</td></tr>
<tr><td></td><td>1 mark each for any of the following, to a maximum of 4 marks:
• Project justification (1)
• Design specification (1)
• Code file (1)
• Testing strategy (1)</td><td>The list contains items included in technical documentation. The candidate may give specific examples of items that are not included in the unit, such as:
• Hardware specification
• Maintenance schedules
• Review schedules
• Recommendations for improvements
• Information sources

Where candidates state specific aspects of Project justification such as:
• analysis and research
• project team
Marks are capped to a maximum of 1 mark for each valid item stated.

Where candidates state specific aspects of testing strategy such as,
• test plan
• test log
• error log
Marks are capped to a maximum of 1 mark for each valid item stated.

Where an item is duplicated within the answers given, either by name or meaning, the duplicated item will not be awarded a mark.

Marks are capped to a maximum of 1 mark for each valid item stated.</td><td>4</td><td>5220-035 311.3.1</td></tr>
<tr><td>AO</td><td colspan="4">AO1</td></tr>
<tr><td>LO</td><td colspan="4">310.1 Produce documentation to support the program</td></tr>
</table>

Q11	Explain the use of the following testing methodologies in software development. • Stress testing. • Data boundary testing.			
	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**
	2 marks each for any of the following, to a maximum of 4 marks: • stress testing is used to verify the functionality of a program under the highest planned load (1) of data transfer volumes (1) from system or user inputs and outputs. • data boundary testing is used to validate that the conditional checks (1) used in algorithms produce the correct outcome (1).	Candidates may give very different explanations from those in the model answers, but the answers must be technically accurate. For example, candidates may use the term 'edge' when explaining data boundary testing. Marks awarded are capped for each separate explanation at a total of 2 marks. Candidates should be allowed to give any valid explanation and marks should be awarded for each distinct element in the explanation. Where a point is duplicated within each explanation, by meaning, the duplicated item will not be awarded a mark.	**4**	**5220-035 310.3.2**
AO	AO2			
LO	310.2 Use testing methodologies			

Q12	Explain the use of the following items when preparing documentation for a software application. • Project timelines. • Test plan.			
	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**
	2 mark each for any of the following, to a maximum of 4 marks: • project timelines are used to define the duration of each phase of a project (1) and for control of resource allocation during the completion of development (1). • test plans are used to define what will be tested during development (1) and are created during the design stage of an application (1).	Candidates may give very different explanations from those in the model answers, but the answers must be technically accurate. For example, the timeline may be described in a specific implementation such as a Gantt chart if the explanation is sufficient. It is important that the test plan explained does not include the features specific to the test log, such as the actual outcomes of the tests. Marks awarded are capped for each separate explanation at a total of 2 marks. Candidates should be allowed to give any valid explanation and marks should be awarded for each distinct element in the explanation. Where a point is duplicated within each explanation, by meaning, the duplicated item will not be awarded a mark.	**4**	**5220-035 310.4.2**
AO	AO2			
LO	310.4 Determine how documentation supports software development			

Q13	Explain the use of **each** of the following techniques when creating well-formed code. • Indentation. • Notes.			
	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**
	2 mark each for any of the following, to a maximum of 4 marks: • indentation is used to indicate separate pieces of code structure (1) by aligning the opening and closing statements of code sections (1). • notes are used as comments that are ignored by the exe compiler (1) to guide the developer and others who read the code about the purpose of the code written (1).	Candidates may give very different explanations from those in the model answers, but the answers must be technically accurate. For example, notes are useful to a large range of stakeholders in developer and client roles, and explanations of their use by such these people are acceptable. Marks awarded are capped for each separate explanation at a total of 2 marks. Candidates should be allowed to give any valid explanation and marks should be awarded for each distinct element in the explanation. Where a point is duplicated within each explanation, by meaning, the duplicated item will not be awarded a mark.	**4**	**5220-035 311/ 312/ 313.1.2**
AO	AO2			
LO	311.1 Create a software application based on a design specification			

Q14

You have been provided with the pseudocode in **Figure.1** as part of an interview process for a position as a software developer technician.

To demonstrate your level of understanding you have been asked to carry out the following **two** tasks. (2 marks)

a) Describe the purpose of the whole pseudocode algorithm in **Figure.1**.

b) Identify and correctly locate using line numbers, **seven** separate coding techniques used in the pseudocode in **Figure 1**. (7 marks)

You must use the following format for your answer:

Line number technique identified

```
1  // The following algorithm has 19 instruction lines
2  array int marks[x]
3  array string outcomes[x]
4
5  int pass = 40
6  int passes = 0
7  int fails = 0
8  int i = 0
9  int a = 0
10 float b = 0
11
12 for (i = 0 to x -1)
13     a = a + marks[i]
14     if marks[i] >= pass
15         passes = passes + 1
16         outcomes[i] = "pass"
17     else
18         fails = fails + 1
19         outcomes[i] = "fail"
20     end if
21 next i
22
23 b = a/x
```

Figure 1.

	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**

<table>
<tr>
<td></td>
<td>
Marks as outlined below to a maximum of 9 marks:

Expected answer

a) The purpose of the whole pseudocode algorithm is that it loops through an array of marks to identify pass/fail (1) grades which are recorded and it then calculates the average of all marks (1).

b) The identified coding techniques can include:

<table>
<tr><th>Line</th><th>Technique used</th></tr>
<tr><td>Line 1</td><td>comment (1)</td></tr>
<tr><td>Lines 2, 3</td><td>Array (1)</td></tr>
<tr><td>Lines 5, 6, 7</td><td>Integer (1)</td></tr>
<tr><td>Line 10</td><td>Float (1)</td></tr>
<tr><td>Lines 5 – 10</td><td>Declare and initialise variables</td></tr>
<tr><td>Lines 5, 6, 7, 8, 9, 10, 13, 15, 16, 18, 19, 23</td><td>Assignment of value to variable</td></tr>
<tr><td>Lines 12-21</td><td>For iteration (1)</td></tr>
<tr><td>Line 14</td><td>Conditional check (1)</td></tr>
<tr><td>Line 14</td><td>Conditional statement (1)</td></tr>
<tr><td>Lines 14 – 20</td><td>Use of if .. else construct</td></tr>
<tr><td>Lines 12, 16 and 19</td><td>Indentation (1)</td></tr>
<tr><td>Line 22</td><td>Arithmetic operation (1)</td></tr>
</table>
</td>
<td>
In response to <u>question 14a)</u> candidates may give a very different description from that in the model answer, but the answers must be technically accurate and describe the purpose of the pseudocode algorithm effectively.
The key marking points are:

identify pass/fail
calculates the average

In response to question 14a) The description is capped at a total of 2 marks.

In response to <u>question 14b)</u> marks should only be awarded where the candidate provides the valid line number and technique in their answer.

Each valid line number and unique technique is awarded 1 mark.
Question 14b) is capped at 7 marks.
</td>
<td>9</td>
<td>5220-035
AO4</td>
</tr>
<tr><td>AO</td><td colspan="4">AO4</td></tr>
<tr><td>LO</td><td colspan="4">Integration</td></tr>
</table>

Q15	You are the lead developer in a software company and have been commissioned to create a program used by customers on their PCs or mobile devices to book tables in a restaurant. You have been asked to produce a document for the programming team discussing the processes that need to be completed to produce the program. The document should use technical language appropriate to the intended audience. Discuss what you would include in your document for the programming team.			
	Acceptable answer(s)	**Guidance**	**Max marks**	**Ref**

	Indicative content:
	A candidate's discussion may include consideration of:
	• Planning
	  ○ Life cycle models
	  ○ Sourcing
	  ▪ Budget
	  ○ Hardware
	  ○ Networks
	  ▪ Wireless
	  ▪ cellular
	  ○ User requirements
	  ▪ target platform
	  ▪ target device(s)
	  ▪ system constraints
	  ○ Legislation and regulations
	  ○ Compliance
	• Design
	  ○ Skill requirements
	  ▪ developers
	  ▪ users
	  ○ Development timescales
	  ○ Data requirements
	  ○ Data storage
	  ○ Interface design
	  ▪ Accessibility
	  ▪ Controls
	  ▪ Mock ups/wireframes
	  ○ Security
	  ▪ Threats
	  ▪ Vulnerabilities
	  ▪ Risks
	  ▪ Data
	  ▪ Countermeasures
	  ○ Hardware
	  ○ Networks
	• Implementation
		0 marks – No awardable material
		
		Band 1:
		1– 3 marks
		The response demonstrates a limited understanding of the processes and technologies involved and is mostly a statement of facts, which are not developed. The approach to the task is inconsistent. Statements may be occasionally incorrect, and the use of precise technical language is sparse.
		
		Band 2:
		4 – 6 marks
		The candidate has produced a discussion that expands on the factual knowledge but lacks detail in some areas. They show an adequate understanding of the processes and technologies involved including some reasons for their selection. They have provided some valid reasons for their choices. The response is structured and presented in a logical order representing the sequences of processes that would be carried out during development.
		
		Band 3:
		7 – 9 marks
		The candidate has shown a thorough understanding of the processes and technologies involved. They have covered these in the correct logical order, including reasons behind the processes and technologies, the factors that need to be considered and the impact these factors may have on the implementation. They have clearly understood how all of the processes and technologies link to one another in terms of order and importance. They have provided valid reasons for their choices. The response is clear, coherent and all information has been logically presented.
			9	**310: 1.1, 1.2, 1.3, 2.1, 2.2, 2.3 3.1, 3.2, 4.1, 4.2.**
				
				31x 1.1, 1.2, 1.3, 2.1, 2.3, 3.1, 3.2, 3.3.

	○ Development software ▪ Appropriate for mobile devices ○ Native platform development options ○ Framework-based development • Programming ○ Style ○ Language ○ Paradigm • Testing ○ test plan ○ test log ○ user acceptance schedules • Deployment ○ private distribution ○ validation • Maintenance ○ Technical documentation ○ Security ○ User support ○ Accounts ○ Fault log ○ Patching and updating			

AO	Integration
LO	AO4 Integration