

Unit 3: Software Development
(3a. Software Development)

Marks: /46

Answer all the questions.

1. A software company decides to release a duplicate file finder which it has named “De-Duplicator”. Duplicate files are files that are exactly the same (bit for bit identical). Space is often wasted on computers by having multiple versions of the same file. Duplicate file finders are programs that find and identify duplicate files on a hard drive so that they can be removed.

* The software team that produces De-Duplicator decides to make a new version that can detect duplicated images the previous version could not. The software team must decide which methodology they will use for the project. Some members of the team suggest extreme programming whilst others would prefer to use the waterfall lifecycle.

Discuss the **two** methodologies and justify which you would recommend.

[12]

2. A software development company is building an operating system for a mobile phone that is in the process of being designed.

The developers follow the waterfall lifecycle.

- (i) List **three** stages of the waterfall lifecycle.

1 _____

2 _____

3 _____ [3]

- (ii) Justify why the waterfall lifecycle is suited to the development of the operating system.

_____ [2]

- (iii) Give **one** disadvantage of using the waterfall lifecycle to develop the operating system.

_____ [1]

3.

A procedure takes as input a number between 1 and 100. It calculates and outputs the square of each number starting from 1, to the number input. The square of a number is the result of multiplying a number by itself.

```
procedure squares()  
do  
    number = int(input("Enter a number between 1 and 100"))  
    until number >= 1 AND number <= 100  
  
    for x = 1 to number  
        print(x * x)  
    next x  
endprocedure
```

The procedure needs to be tested.

(i) Describe how black box testing can be used to test a program.

[3]

(ii) For each type of test given in the table, identify **two** examples of test data that can be used to test the program.

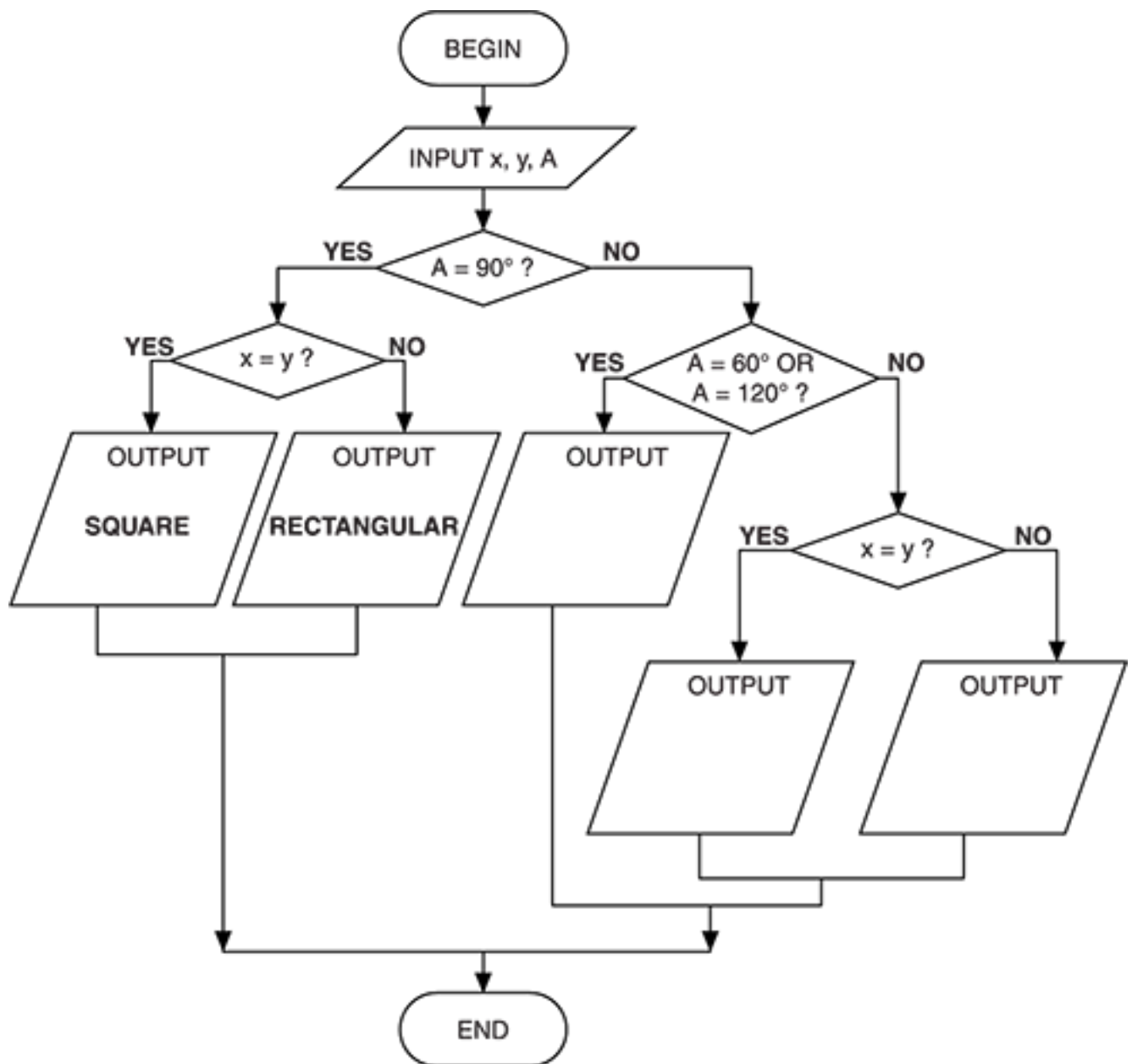
Test Type	Test Data 1	Test Data 2
Normal		
Extreme		
Invalid		

[3]

4. Beryl has to write a program that explains patterns in crystals, using the following information.

All the patterns in crystals have two lengths, x and y , and an angle A .

- If A is 90° you need to check the lengths.
 - If the lengths are equal it is a square crystal.
 - If the lengths are **not** equal it is a rectangular crystal.
- If A is **not** 90° it may be a hexagonal crystal. These crystals have angles of 60° and 120° and the lengths are always equal.
- If A is **not** 60° or 90° or 120° it must be a parallelogram crystal if the lengths are not equal, or a rhombic crystal if the lengths are equal.



During alpha testing, both white box testing and black box testing are used.

(i) State what is meant by alpha testing.

----- [1]

(ii) Describe how Beryl will use white box testing in her program.

----- [2]

(iii) Beryl prepares a set of test data for black box testing. Three test cases where the angle is exactly 90° are given in the table below.

Complete the table by stating the values of x and y to be tested, the reason for the test and the expected outcome. The first row has been completed as an example.

Test data	Reason for test	Expected outcome
A = 90 x = 100 y = 100	The angle is exactly 90 and the two sides are exactly equal	SQUARE
A = 90 x = ----- y = -----		
A = 90		

x = ----- y = -----		
----------------------------	--	--

[6]

5(a). Given the following pseudocode:

```

d = 5

if ((a > b) OR (b >= c)) then
    if ((c < a ) XOR (c < b)) then // Check to see if one or the other
                                    // comparisons are TRUE, but not both
        d = 15
    else
        d = 16
    endif
else
    d = 14
endif

print (d)

```

State the value of d if a=42, b=41 and c=42

(b). State the value of d if a=42, b=36 and c=4

(c). State the value of d if a=42, b=36 and c=36

(d). Give **one** potential value of b if the output value of a=42, c=44 and d=14.

[4]

6. A programmer is going to design a procedure that will prompt for and receive two values, A and B. The procedure will then compare them. The procedure will also write a suitable message to a file on disk depending on whether:

- the values are the same
- A is less than B, or
- B is less than A.

Use pseudocode to write the procedure.

[5]

7. A software development team is writing a word game.

The team is using Rapid Application Development.

Describe the Rapid Application Development process.

[4]

END OF QUESTION PAPER

Question	Answer/Indicative content	Marks	Guidance
1	<p>Mark Band 3–High Level (9–12 marks) The candidate demonstrates a thorough knowledge and understanding of both methodologies; the material is generally accurate and detailed.</p> <p>The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence / examples will be explicitly relevant to the explanation.</p> <p>The candidate is able to weigh up both sides of the argument which results in a supported and realistic judgment as to which methodology should be used.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Mark Band 2–Mid Level (5–8 marks) The candidate demonstrates reasonable knowledge and understanding of both methodologies; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence / examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to come to a conclusion showing some recognition of influencing factors that would determine which methodology should be used.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</i></p> <p>Mark Band 1–Low Level (1–4 marks) The candidate demonstrates a basic knowledge of methodologies with limited</p>	12	<p>If only one methodology considered – MAX 6 marks.</p> <p>AO1: Knowledge and Understanding The following is indicative of possible factors / evidence that candidates may refer to but is not prescriptive or exhaustive:</p> <ul style="list-style-type: none"> • The waterfall lifecycle involves linear stages whereas XP takes on an agile, iterative approach. • The waterfall lifecycle establishes requirements in early stages and subsequent stages focus on these – new requirements can be adopted throughout XP. • The waterfall lifecycle focuses on the end user at the start and then they may be consulted at different points throughout the project whereas an end user is integral throughout XP. • In the waterfall lifecycle the development phase focuses on code that meets the requirements / design. In XP the quality of the code is an important factor – paired programming helps focus on this. • The waterfall lifecycle although adopted for large projects it can be inflexible and limits changing requirements. <p>AO2.1: Application The selected knowledge / examples should be directly related to the specific question.</p> <ul style="list-style-type: none"> • Discussion of how the methodologies would impact upon the choices made regarding abstraction, any preconditions and how they are addressed. • Discussion around how the methodologies would impact the order of steps in any procedures and how sub-procedures would be implemented • How the methodologies could

Question	Answer/Indicative content	Marks	Guidance
	<p>understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.</p> <p>The candidate provides nothing more than an unsupported assertion. <i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks No attempt to answer the question or response is not worthy of credit.</p>		<p>potentially affect how decisions and the logic involved are dealt with and how concurrency is dealt with</p> <ul style="list-style-type: none"> • Discussion of other social factors that affect the use of the different methodologies. <p>AO3.3: Evaluation Having considered the different sides to the argument candidates will need to reach a supported judgment based on the evidence included in their response.</p> <p>There should be no bias in marks as to which methodology is chosen but especially in the top mark band there must be a clear link between the points candidates have made and justification.</p> <p>e.g. The waterfall lifecycle establishes requirements in early stages and subsequent stages focus on these. New requirements can be adopted throughout XP. The requirements in this project are likely to be static making the Waterfall model a more appropriate approach.</p> <p>OR</p> <p>In the waterfall lifecycle the development phase focuses on code that meets the requirements / design. In XP the quality of the code is an important factor. Paired programming helps focus on this.</p> <p>For this utility to be successful it must work more efficiently than its competitors and code developed through XP is more likely to achieve this, therefore XP is a more appropriate approach.</p>
	Total	12	

Question			Answer/Indicative content	Marks	Guidance
2		i	<ul style="list-style-type: none"> - Feasibility Study - Investigation / Requirements Elicitation - Analysis - Design - Implementation / Coding - Testing - Installation - Documentation - Evaluation - Maintenance (1 per –, max 3)	3	
		ii	<ul style="list-style-type: none"> - Tends to suit large scale projects ... - ..An OS is an example of such a big project. - Tends to suit projects with stable requirements ... - ... And the base requirements of an OS are unlikely to change. (1 per –, max 2)	2	
		iii	If a change does occur in the requirements the lifecycle cannot respond easily, often at the cost of time and money.	1	
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
3		i	1 mark per bullet <ul style="list-style-type: none"> • Tests the expected output... [1] • ...based on input [1] • Does not look at the code // looks only at program specification [1] 	3 AO1.2 (3)	Examiner's Comment: Many candidates had a weak grasp of different testing methodologies and confused black box testing with alpha, beta and white box testing. This was disappointing as it was a question that could have been answered well from basic recall.
		ii	1 mark for two suitable normal data 1 mark for two suitable extreme data 1 mark for two suitable invalid data Normal: any values between 1 and 100 (inclusive) [1] Extreme: 1, 100 [1] Invalid: <1, >100, "x" [1]	3 AO2.1 (3)	Examiner's Comment: Many candidates could suggest sensible values for normal test data, but fewer understood how extreme and invalid data differed.
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
4		i	<ul style="list-style-type: none"> Testing done by the programmer / Beryl / Developers employee(s) 	1	<p>Examiner's Comments</p> <p>On the whole this was answered well, and also in the context of the question.</p>
		ii	<ul style="list-style-type: none"> Using the source code Check every possible path / condition statements Dry Runs / Trace Tables 	2	<p>Accept statements</p> <p>Examiner's Comments</p> <p>It was not clear from the answers given by some candidates whether they were describing black or white box testing. Few mentioned the use of Dry Runs or Trace Tables.</p>
		iii	<p><i>Award marks in groups of three, for:</i></p> <ul style="list-style-type: none"> Outcome: Rectangle Reason :Angle 90 and difference between x and y $\geq 10\%$ of x Test data matches the expected outcome Outcome: Square Reason: Angle 90 and difference between x and y $< 10\%$ of x Test data matches expected outcome 	6	<p>Note: If expected outcome is wrong then do not award marks for other columns</p> <p>Examiner's Comments</p> <p>This question was on the whole answered poorly. Few candidates took into account the tolerance of $< 10\%$ when deciding the outcome, with a few candidates just repeating the example given.</p>
			Total	9	
5	a		<ul style="list-style-type: none"> 16 	4	Max 4 marks
	b		<ul style="list-style-type: none"> 16 		
	c		<ul style="list-style-type: none"> 15 		
	d		<ul style="list-style-type: none"> 42 43 <p>(max. 1)</p>		<p>Examiner's Comments</p> <p>Candidates generally achieved some success, but few scored all four marks. Those who could reason logically and who understood the XOR function gained most credit.</p>
			Total	4	

Question		Answer/Indicative content	Marks	Guidance
6		<ul style="list-style-type: none"> • Read in A and B. • Correct comparisons • Correct output messages. • Open file • Write to and close file. <p>E.g.</p> <pre>A = input("Enter value A") B = input("Enter value B") myFile = openWrite("output.txt") if A < B then myFile.WriteLine("A is less than B") elseif B < A then myFile.WriteLine("B is less than A") else myFile.WriteLine("A is equal to B") endif myFile.close()</pre>	5	<p>Max 5 marks</p> <p>Accept open file in append mode</p> <p>Examiner's Comments</p> <p>Many candidates gained some credit for this question, but many did not appreciate the fact that a file needed to be opened and closed.</p>
		Total	5	
7		<ul style="list-style-type: none"> – Prototype is created (1) – (Evaluated and) feedback used to inform next iteration (1) – Any changes are made (1) – Process repeated until...(1) ...prototype becomes final product. (1) <p>(Max 4)</p>	4 (AO1.1)	<p>Examiner's Comments</p> <p>Most candidates gained some marks on this question but few achieved full marks. In general responses lacked attention to detail and clarity of expression. Centres should advise candidates that the number of marks awarded for questions gives an indication of the number of points required in the response.</p>
		Total	4	