OCR
Oxford Cambridge and RSA

GCE

Computer Science

Unit **H446/02:** Algorithms and programming

Advanced GCE

Mark Scheme for June 2018

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

Annotations

Annotation	Meaning
^	Omission mark
BOD	Benefit of the doubt
	Incorrect point
FT	Follow through
NAQ	Not answered question
NBOD	No benefit of doubt given
REP	Repeat
	Correct point
TV	Too vague
BP	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of
L1	Level 1
L2	Level 2
L3	Level 3

Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper and its rubrics
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

USING THE MARK SCHEME

Please study this Mark Scheme carefully. The Mark Scheme is an integral part of the process that begins with the setting of the question paper and ends with the awarding of grades. Question papers and Mark Schemes are developed in association with each other so that issues of differentiation and positive achievement can be addressed from the very start.

This Mark Scheme is a working document; it is not exhaustive; it does not provide 'correct' answers. The Mark Scheme can only provide 'best guesses' about how the question will work out, and it is subject to revision after we have looked at a wide range of scripts.

The Examiners' Standardisation Meeting will ensure that the Mark Scheme covers the range of candidates' responses to the questions, and that all Examiners understand and apply the Mark Scheme in the same way. The Mark Scheme will be discussed and amended at the meeting, and administrative procedures will be confirmed. Co-ordination scripts will be issued at the meeting to exemplify aspects of candidates' responses and achievements; the co-ordination scripts then become part of this Mark Scheme.

Before the Standardisation Meeting, you should read and mark in pencil a number of scripts, in order to gain an impression of the range of responses and achievement that may be expected.

In your marking, you will encounter valid responses which are not covered by the Mark Scheme: these responses must be credited. You will encounter answers which fall outside the 'target range' of Bands for the paper which you are marking. Please mark these answers according to the marking criteria.

Please read carefully all the scripts in your allocation and make every effort to look positively for achievement throughout the ability range. Always be prepared to use the full range of marks.

LEVELS OF RESPONSE QUESTIONS:

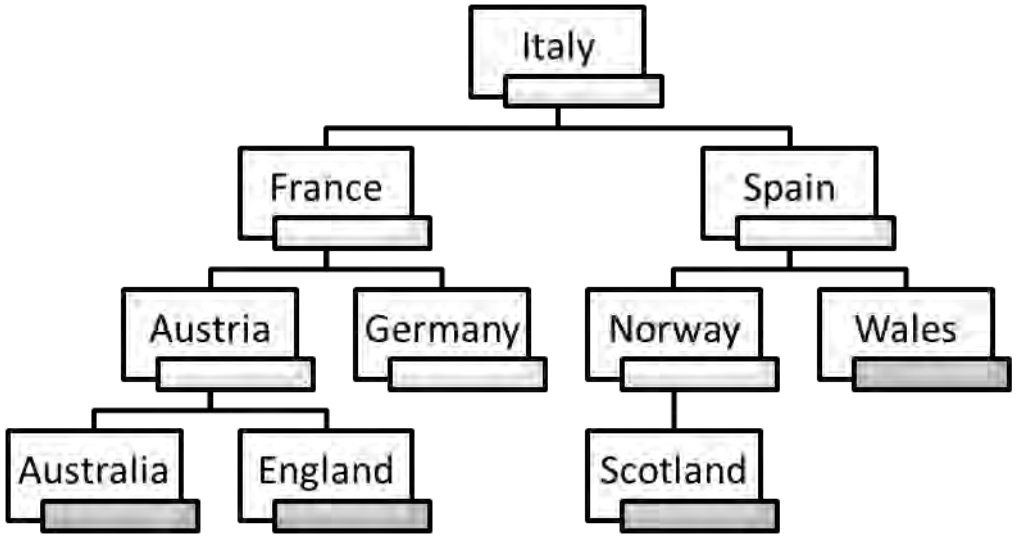
The indicative content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.
Using 'best-fit', decide first which set of BAND DESCRIPTORS best describes the overall quality of the answer. Once the band is located, adjust the mark concentrating on features of the answer which make it stronger or weaker following the guidelines for refinement.

- **Highest mark:** If clear evidence of all the qualities in the band descriptors is shown, the HIGHEST Mark should be awarded.
- **Lowest mark:** If the answer shows the candidate to be borderline (i.e. they have achieved all the qualities of the bands below and show limited evidence of meeting the criteria of the band in question) the LOWEST mark should be awarded.
- **Middle mark:** This mark should be used for candidates who are secure in the band. They are not 'borderline' but they have only achieved some of the qualities in the band descriptors.

Be prepared to use the full range of marks. Do not reserve (e.g.) high Band 3 marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the band descriptors, reward appropriately.

	AO1	AO2	AO3
High (thorough)	Precision in the use of question terminology. Knowledge shown is consistent and well-developed. Clear appreciation of the question from a range of different perspectives making extensive use of acquired knowledge and understanding.	Knowledge and understanding shown is consistently applied to context enabling a logical and sustained argument to develop. Examples used enhance rather than detract from response.	Concerted effort is made to consider all aspects of a system / problem or weigh up both sides to an argument before forming an overall conclusion. Judgements made are based on appropriate and concise arguments that have been developed in response resulting in them being both supported and realistic.
Middle (reasonable)	Awareness of the meaning of the terms in the question. Knowledge is sound and effectively demonstrated. Demands of question understood although at times opportunities to make use of acquired knowledge and understanding not always taken.	Knowledge and understanding applied to context. Whilst clear evidence that an argument builds and develops through response there are times when opportunities are missed to use an example or relate an aspect of knowledge or understanding to the context provided.	There is a reasonable attempt to reach a conclusion considering aspects of a system / problem or weighing up both sides of an argument. However the impact of the conclusion is often lessened by a lack of supported judgements which accompany it. This inability to build on and develop lines of argument as developed in the response can detract from the overall quality of the response.
Low (basic)	Confusion and inability to deconstruct terminology as used in the question. Knowledge partial and superficial. Focus on question narrow and often one-dimensional.	Inability to apply knowledge and understanding in any sustained way to context resulting in tenuous and unsupported statements being made. Examples if used are for the most part irrelevant and unsubstantiated.	Little or no attempt to prioritise or weigh up factors during course of answer. Conclusion is often dislocated from response and any judgements lack substance due in part to the basic level of argument that has been demonstrated throughout response.

	Assessment Objective
AO1	Demonstrate knowledge and understanding of the principles and concepts of computer science, including abstraction, logic, algorithms and data representation.
AO1.1	Demonstrate **knowledge** of the principles and concepts of abstraction, logic, algorithms, data representation or other as appropriate.
AO1.2	Demonstrate **understanding** of the principles and concepts of abstraction, logic, algorithms, data representation or other as appropriate.
AO2	Apply knowledge and understanding of the principles and concepts of computer science including to analyse problems in computational terms.
AO2.1	Apply knowledge and understanding of the principles and concepts of computer science.
AO2.2	Analyse problems in computational terms.
AO3	Design, program and evaluate computer systems that solve problems, making reasoned judgements about these and presenting conclusions.
AO3.1	Design computer systems that solve problems.
AO3.2	Program computer systems that solve problems.
AO3.3	Evaluate computer systems that solve problems, making reasoned judgements about these and presenting conclusions.

Question			Answer	Marks	Guidance
1	(a)		 1 mark for each of: - Scotland in correct place - Wales in correct place - Australia and England both in correct place	**3** **AO2.2 (3)**	
1	(b)		1 mark per bullet to max • Italy • France, Spain • Austria, Germany, Norway	**3** **AO1.1 (1)** **AO2.1 (1)** **AO2.2 (1)**	

Question			Answer	Marks	Guidance

1	(c)	(i)	1 mark per bullet to max 5
			`function searchForData(currentNode:byVal, searchValue:byVal)`
			`  thisNode = getData(`**`currentNode`**`)`
			`  if thisNode == `**`searchValue`**` then`
			`  return `**`true`**
			`  elseif thisNode < searchValue then`
			`  if currentNode.left () != null then`
			`  return (searchForData(currentNode.left (), searchValue))`
			`  else`
			`  return `**`false`**
			`  endif`
			`  else`
			`  if `**`currentNode.right()`**` != null then`
			`  return (searchForData(currentNode.right (), searchValue))`
			`  else`
			`  return false`
			`  endif`
			`  endif`
			`endfunction`
				5
				AO2.2 (2)
				AO3.2 (3)
					The line **`elseif thisNode < searchValue then`** should have read **`elseif thisNode > searchValue then`**
					
					If candidates attempt to correct the code and their answers are consistent with, and work with their amendment, such answers should be credited.

1	(c)	(ii)	• It's a binary tree • It's ordered / sorted	**2** **AO2.2 (2)**	

Question			Answer	Marks	Guidance
2	(a)	(i)	Recognition • Identify there is a problem to be solved // what the problem is Decomposition • Splitting down a problem into sub-problems	2 AO1.1 (2)	
2	(a)	(ii)	e.g. • Divide and conquer • Abstraction	1 AO1.1 (1)	Accept other credible answers e.g.: Critical thinking, Modelling, Heuristics, Concurrency, Visualisation, Backtracking
2	(b)	(i)	• Turning large quantities of data into useful information / Finding patterns within large quantities of information	1 AO1.1 (1)	Must refer to large quantities of data
2	(b)	(ii)	1 mark per identifying data, 1 for use e.g. • Identify customer trends • To identify items to sell/offers to send customers • Identify which stores are making the most profit • To identify what the other stores are doing well • Which items are not selling well • To replace them with other items	4 AO2.2 (4)	Accept any valid responses
2	(c)	(i)	Simulate/test the behaviour of the system before it is used	1 AO1.1 (1)	
2	(c)	(ii)	e.g. • Testing it with a large number of simultaneous orders (stress testing) • Testing it with a large number of customers/items/orders	1 AO2.2 (1)	
2	(d)		1 mark per bullet to max 2 e.g. • the components can be used in a future program… • they do not need to be rewritten / saves time	2 AO1.1 (1) AO2.1 (1)	

Question			Answer	Marks	Guidance
			• they have already been tested… • …it will save time		
3	(a)	(i)	Any one from: - A graph has cycles - A graph can be directed/undirected - A tree has a hierarchy (e.g. Parent/Child)	1 AO1.2 (1)	Allow any appropriate description e.g. graph can be weighted, tree has a root
3	(a)	(ii)	1 mark per bullet to max 2 • The puzzle is not shown in the diagram • The graph shows different sequences of sub problems in the puzzle that can be solved to get to the final solution • The puzzle does not have all states visible at once	2 AO1.2 (1) AO2.1 (1)	Answers must be in context of the puzzle
3	(a)	(iii)	1 mark per bullet to max 2 e.g. • Visualisations benefit humans rather than computers • Visualisations present the information in a simpler form to understand • Visualisations can best explain complex situations	2 AO1.1 (1) AO2.1 (1)	
3	(b)		1 mark per bullet • Mark A as the initial node and then visit B (5) • Node E (8) is then visited (chosen from C (13), D (14), E (8)) • Node I (12) is then visited after E • Node J (14) is then visited after I : • Visiting G (18) from I; • Visiting G (15) from C – <u>overriding</u> the previous value of 18 • solution A-B-E-I-J path length 14	7 AO1.2 (3) AO2.1 (2) AO2.2 (2)	

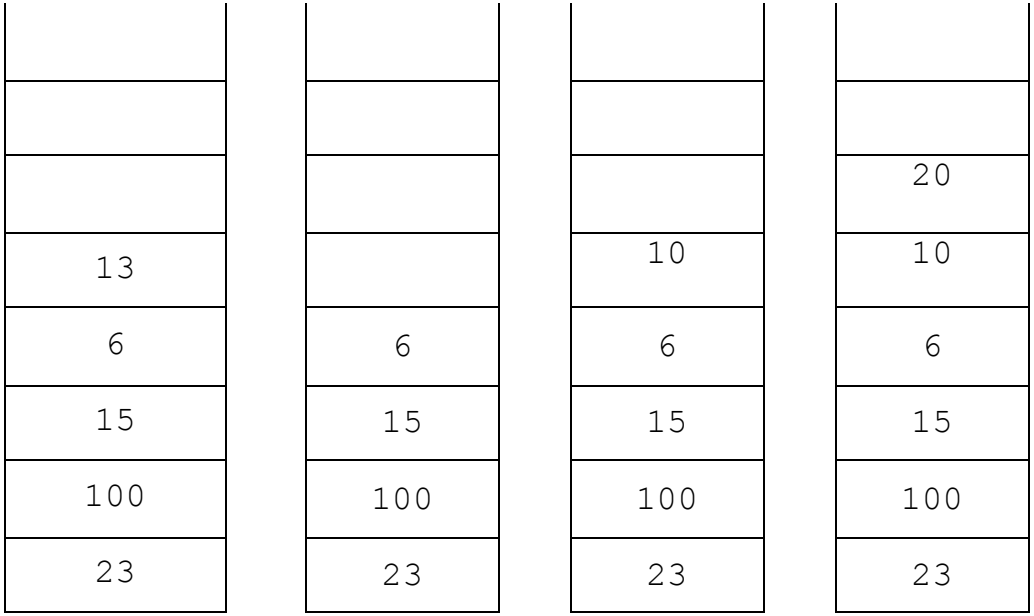
Question			Answer	Marks	Guidance
3	(c)		**Mark Band 3 – High level** **(7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of Dijkstra's and A*; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2 – Mid level** **(4-6 marks)** The candidate demonstrates reasonable knowledge and understanding of Dijkstra's and A*; 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 provides a reasonable discussion, the majority of which is focused. Evaluative comments are, for the most part appropriate, although one or two opportunities for development are missed. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* **Mark Band 1 – Low Level** **(1-3 marks)** The candidate demonstrates a basic knowledge of Dijkstra's and A* with limited understanding shown; the material is basic and contains some inaccuracies. The candidates makes a limited attempt to apply acquired knowledge and	**9** **AO1.1 (2)** **AO1.2 (2)** **AO2.1 (2)** **AO3.3 (3)**	**AO1: Knowledge and Understanding** **Indicative content** • Heuristic helps produce a solution in a faster time • A* uses estimated distance from final node • Dijkstra uses a weight/distance • A* chooses which path to take next based on lowest current distance travelled **AO2: Application** • Description of how A* will differ from Dijkstra, e.g. taking the shorter route A-B-E-I before exploring nodes from D and E • Description of the different number of comparisons that would be needed in this problem • A* doesn't need to find all possible solutions (saves time) **AO3: Evaluation** Candidates will need to evaluate the benefits and drawbacks of each algorithm • Small-scale problem • Quick to find a solution using either method • Difference in programming complexity is minimal • Don't know if this problem needs to scale • Most efficient route needed

Question			Answer	Marks	Guidance
			understanding to the context provided. The candidate provides a limited discussion which is narrow in focus. Judgements if made are weak and unsubstantiated. *The information is basic and comunicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit.		
3	**(d)**		1 mark per bullet to max 4 e.g. • Underlines syntax errors dynamically • Can be corrected before running // saves times • Watch window • View how variables change during running of the program • Break points • Stop the program at set points to check the values of variables • Error message list • Tells you where errors are and suggests corrections • Step-mode • Executes program one statement at a time to watch variable values and program pathways • Traces • Print-outs of variable values for each statement	**6** **AO1.1 (3)** **AO1.2 (3)**	

Question			Answer	Marks	Guidance
			execution within a program • Crash-dump/post-mortem routine • Shows the state of variables where an error occurs • Stack contents • Shows sequencing through procedures/modules • Cross-referencers • Identifies where variables/constants are used in a program to avoid duplications		
4	(a)		1 mark per bullet for working to max 6 • generate(7) return 7 + (generate(8) DIV 2) • generate(8) return 8 + (generate(9) DIV 2) generate(9) return 9 + (generate(10) DIV 2) generate(10) return 10 + (generate(11) DIV 2) • generate(11) return 10 • Rewinding: return 10 + (10 DIV 2) = 10 + 5 = 15 • return 9 + (15 DIV 2) = 9 + 7 = 16 return 8 + (16 DIV 2) = 8 + 8 = 16 • return 7 + (16 DIV 2) = 7 + 8 = 15	**6** **AO1.2 (1)** **AO2.2 (5)**	

Question			Answer	Marks	Guidance
4	(b)		• If the value is sent by value, num1 will not be overridden / it is a copy of the parameter that is used (1) and this will produce the correct output (1) • if the parameter had been passed by reference it would not produce the correct result (1) as num1 would be overridden / because it is a pointer to the address of the variable (1)	**2** **AO2.1 (1)** **AO2.2 (1)**	
4	(c)		**Mark Band 3 – High level** **(7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of parameters and global variables; the material is generally accurate and detailed. 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. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2 – Mid level** **(4-6 marks)** The candidate demonstrates reasonable knowledge and understanding of parameters and global variables; 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 provides a reasonable discussion, the majority of which is focused. Evaluative comments are, for the most part appropriate, although one or two opportunities for development are missed. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and*	**9** **AO1.1 (2)** **AO1.2 (2)** **AO2.1 (2)** **AO3.3 (3)**	**AO1: Knowledge and Understanding** **Indicative content** • Parameter allows a value to be sent to a sub-program • Global variables can be accessed throughout the scope of the program • Local variables can only be accessed within the scope of the sub-program it's defined within – a parameter becomes a local variable in the function **AO2: Application** • If global, equivalent of by reference -value would be over-ridden • Global variable takes more memory than a local variable/parameter • In recursion, each call produces a new local variable for num1 **AO3: Evaluation** Candidates will need to evaluate the benefits and drawbacks of each algorithm • Global would require altering the algorithm as the value would be over-ridden on each call • Global would mean that memory space is kept throughout the running of the program, not just the sub-program • Parameter enables memory to be reallocated • Many more memory spaces needed for parameter

Question			Answer	Marks	Guidance
			supported by some evidence. **Mark Band 1 – Low Level** **(1-3 marks)** The candidate demonstrates a basic knowledge of parameters and global variables with limited understanding shown; the material is basic and contains some inaccuracies. The candidates makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides a limited discussion which is narrow in focus. Judgements if made are weak and unsubstantiated. *The information is basic and comunicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit.		in recursion, 1 for each call

Question			Answer	Marks	Guidance
4	(d)		1 mark per bullet • Each recursive call stores the current state on the stack // creates new variables • Iteration reuses the same variables	2 AO1.2 (1) AO2.1 (1)	
5	(a)		1 mark for each correct stack  	**4** **AO1.2 (2)** **AO2.2 (2)**	
5	(b)	(i)	1 mark per bullet, max 2 for insert, max 2 for remove push • Check if the stack is full (pointer = array.length/array.length+1) • If it is not – insert the item • If it is – return/error that the stack is full pop • Check if the stack is empty (pointer = 0/1) • If it is – return/error that the stack is empty • If it is not – return the item	4 AO1.2 (2) AO2.2 (2)	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td>(b)</td><td>(ii)</td><td>1 mark per line, 1 for change
• line 02
• Include an OR with variations (e.g. <code>userAnswer = "PUSH" OR userAnswer = "Push"</code> etc.)/Convert input to uppercase/lowercase and just compare to equivalent</td><td>2
AO2.2 (2)</td><td></td></tr>
<tr><td>5</td><td>(c)</td><td></td><td>1 mark per bullet to max 3
• Array size defined
• A stack pointer is used to point to the top of the stack
• When an item is pushed the stack pointer is incremented
• When an item is popped the stack pointer is decremented</td><td>3
AO1.2 (1)
AO2.1 (1)
AO2.2 (1)</td><td></td></tr>
<tr><td>5</td><td>(d)</td><td>(i)</td><td>1 mark per row (after first row)
<table><tr><td>100</td><td>22</td><td>5</td><td>36</td><td>999</td><td>12</td><td></td></tr><tr><td>22</td><td>100</td><td>5</td><td>36</td><td>999</td><td>12</td><td>1 mark</td></tr><tr><td>5</td><td>22</td><td>100</td><td>36</td><td>999</td><td>12</td><td>1 mark</td></tr><tr><td>5</td><td>22</td><td>36</td><td>100</td><td>999</td><td>12</td><td>1 mark</td></tr><tr><td>5</td><td>22</td><td>36</td><td>100</td><td>999</td><td>12</td><td>1 mark</td></tr><tr><td>5</td><td>12</td><td>22</td><td>36</td><td>100</td><td>999</td><td>1 mark</td></tr></table></td><td>5
AO2.2 (5)</td><td></td></tr>
<tr><td>5</td><td>(d)</td><td>(ii)</td><td>1 mark per bullet to max 7
• Repeat
• Calculating an array midpoint…
• …by adding the array lower bound to the array upper bound, dividing by 2 and rounding
• Compare array midpoint with value to search for…
• …if equal set found flag to true
• …if array midpoint < value to search for, change lowerbound to equal midpoint + 1
• …if array midpoint > value to search for, change upperbound to equal midpoint – 1
• Until lowerbound is greater than or equal to upperbound
• Return/output found flag</td><td>7
AO1.1 (2)
AO1.2 (3)
AO2.1 (1)
AO2.2 (1)</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance

5	(d)	(iii)	1 mark per bullet
			• Setting variable to start at 0
			• Suitable while structure (endwhile or clear indentation)
			• looping 50 times
			• Incrementing the variable within the loop
			
			e.g. 1
			`function searchItem(dataItem)`
			`  count = 0`
			`  while count < 50`
			`  if dataArray(count) == dataItem then`
			`  return(count)`
			`  endif`
			`  count = count + 1`
			`  endwhile`
			`  return(-1)`
			`endfunction`
			
			e.g. 2
			`function searchItem(dataItem)`
			`  count = 0`
			`  while count < 50 and dataArray[count]!=dataItem`
			`  count = count + 1`
			`  endwhile`
			`  if  count==50`
			`  count=-1`
			`  endif`
			`  return(count)`
			`endfunction`
				4
				AO1.2 (1)
				AO3.1 (1)
				AO3.2 (2)	

Question			Answer	Marks	Guidance
6	(a)	(i)	1 mark per bullet to max 3 • Record is a data structure… • …A class is a template for making data structures (objects) • Class also has methods (which describes functionality) • Both store data of different types • Which can be accessed by their names • But classes can make them accessible via methods • Both can have multiple 'instances' • Class can include visibility of properties / private	3 AO1.2 (3)	
6	(a)	(ii)	1 mark per space `recordStructure` **`items`** `itemName` **`:`** **`String`** **`cost`** **`:`** `Currency` **`dateArrival`** **`:`** `Date` `transferred` **`:`** **`Boolean`** `endRecordStructure`	5 AO2.2 (2) AO3.2 (3)	

6	(a)	(iii)	1 mark per bullet to max 3
			• Declaring box1 as an item
			• Using Box1. (or equivalent) for each variable
			• Setting each variable (matching 6aii) correctly
			
			e.g.
			`Box1 : Items`
			`Box1.itemName = "Box"`
			`Box1.cost = 22.58`
			`Box1.dateArrival = "1/5/2018"`
			`Box1.transfered = True`
				3
				AO2.2 (2)
				AO3.2 (1)
					Ensure variable names for cost and dateArrival are consistent with variable names given in a(ii)

6	(b)	(i)	1 mark per bullet to max 2 • A data structure • FIFO (first in first out)	2 AO1.1 (2)	

Question			Answer	Marks	Guidance
6	(b)	(ii)	1 mark per bullet to max 2 • Properties (are encapsulated) and can only be accessed through their methods • Enforce validation through the method // inappropriate data can be caught before entered • Cannot be changed/accessed accidentally	2 AO1.2 (2)	

6	(b)	(iii)	1 mark per bullet to max
			• Constructor method/`new`
			• Setting `head` and `tail` to 0 within constructor method
			
			e.g.
			`public procedure new()`
			`  head = 0`
			`  tail = 0`
			`  numItems = 0`
			`endprocedure`
				2
				AO2.2 (1)
				AO3.2 (1)	

Question			Answer	Marks	Guidance

6	(b)	(iv)	1 mark per bullet to max 6
			• Function declaration, taking item as a parameter
			• Checking if the queue is full…
			• …outputting/reporting error and returning `false`
			• Adding the item to the `tail` position
			• Correctly updating the `tail` pointer (either before or after addition)
			• Incrementing `numItems` and returning `true` if successful
			
			e.g.
			`public function enqueue(newItem : items) : boolean`
			`  if numItems = 10 then`
			`  print("Error: The queue is full")`
			`  return false`
			`  else`
			`  theItems[tail] = newItem`
			`  if tail = 9 then`
			`  tail = 0`
			`  else`
			`  tail += 1`
			`  endif`
			`  numItems += 1`
			`  return true`
			`  endif`
			`endprocedure`
				6
				AO2.2 (3)
				AO3.1
				(1)
				AO3.2 (2)	

6	(b)	(v)	e.g. `myItems = (new) itemQueue()`	1 AO2.1 (1)	Allow follow through if they have parameters in 6(b)(iii)

Question			Answer	Marks	Guidance

6	(b)	(vi)	1 mark per bullet to max 5
			• Procedure declaration for `insertItems`
			• Asking for input of data items for a new item …..
			• …using record structure correctly
			• Use of `myItems.enqueue`
			• Looping while the queue is not full
			
			e.g.
			`procedure insertItems()`
			
			`  newItem : Items`
			`  itemCount = myItems.getnumItems()`
			
			`  while itemCount < 10`
			`  newItem.itemName = input("Enter the item name")`
			`  newItem.cost = input("Enter the item cost")`
			`  newItem.dateArrival = input("Enter the date of arrival")`
			`  newItem.transferred = input("Has it been transferred?")`
			`  myItems.enqueue(newItem)`
			`  itemCount = itemCount + 1`
			`  endwhile`
			
			`  myItems.setnumItems(itemCount)`
			
			`endprocedure`
				5
				AO2.2 (2)
				AO3.1 (1)
				AO3.2 (2)	

6	(b)	(vii)	1 mark per bullet to max 2 • Store the items and queue to an external file (when the program closes) • Load the items and queue from the file when it starts	2 AO2.1 (1) AO2.2 (1)	

Question			Answer	Marks	Guidance
6	(c)		**Mark Band 3 – High level** **(7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of caching and concurrent processing; the material is generally accurate and detailed. 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. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2 – Mid level** **(4-6 marks)** The candidate demonstrates reasonable knowledge and understanding of caching and concurrent processing; 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 provides a reasonable discussion, the majority of which is focused. Evaluative comments are, for the most part appropriate, although one or two opportunities for development are missed. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* **Mark Band 1 – Low Level** **(1-3 marks)** The candidate demonstrates a basic knowledge of caching and concurrent processing with limited understanding shown; the material is basic and contains some inaccuracies. The candidates makes a limited attempt to	**9** **AO1.1 (2)** **AO1.2 (2)** **AO2.1 (2)** **AO3.3 (3)**	**AO1: Knowledge and Understanding** **Indicative content** Caching • Previously used data is stored in a location… • that can be quickly accessed … • to speed up retrieval if needed in future Concurrent Processing • several processes work simultaneously to solve a problem **AO2: Application** Caching • search for previously searched for data items in a faster secondary storage device/RAM • Speed up access for that item …Relies on same item being searched for multiple times …Kamran needs to decide how feasible this is based on the number of item Concurrent • Computer would have multiple processors… • Each searching part of the data structure at one time… • This would be limited by bottlenecks such as accessing the storage device • The n processors could potentially mean an increase of up to 1/n of time…realistically speed increase is likely to be less than that • Only useful if using linear search // binary search cannot be performed concurrently **AO3: Evaluation** Candidates will need to evaluate the benefits and drawbacks of caching and concurrent processing Allow any point of view (caching / concurrent / both) as long as argument is presented suitably.

Question			Answer	Marks	Guidance
			apply acquired knowledge and understanding to the context provided. The candidate provides a limited discussion which is narrow in focus. Judgements if made are weak and unsubstantiated. *The information is basic and comunicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit.		

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