

Name:

Class Teacher:

Date:



OCR J276

GCSE Computer Science

REVISION BOOKLET – MARK SCHEME

2.2 PROGRAMMING TECHNIQUES

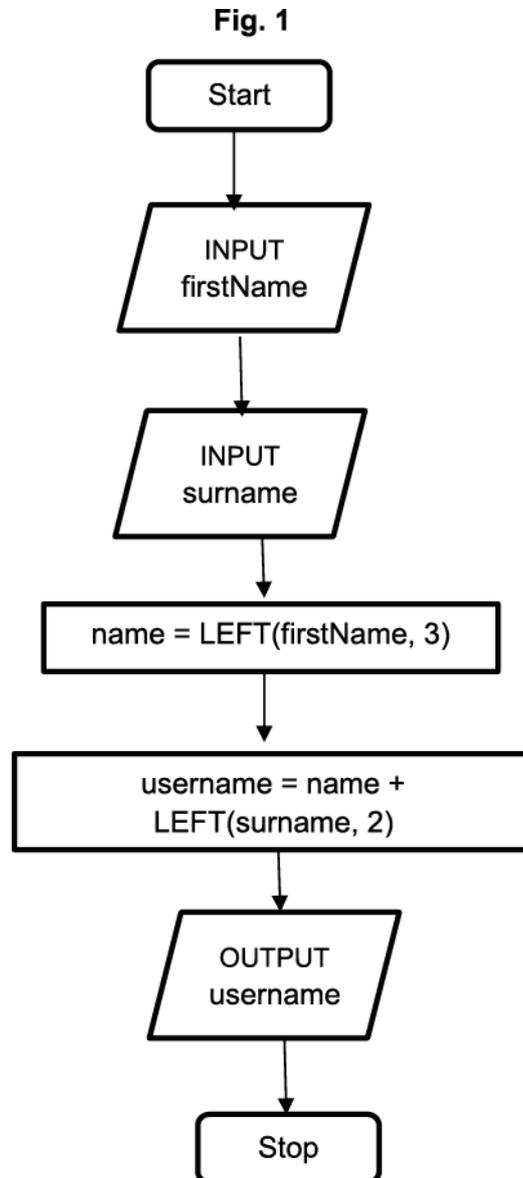
Content in J276 GCSE Computer Science:

- 1.1 Systems Architecture
- 1.2 Memory
- 1.3 Storage
- 1.4 Wireless and Wired Networks
- 1.5 Network Topologies, Protocols and Layers
- 1.6 System Security
- 1.7 Systems Software
- 1.8 Ethical, Legal, Cultural and Environmental Concerns
- 2.1 Algorithms
- 2.2 Programming Techniques
- 2.3 Producing Robust Programs
- 2.4 Computational Logic
- 2.5 Translators and Facilities of Languages
- 2.6 Data Representation

EXAM QUESTIONS

QUESTION 1

Johnny is writing a program to create usernames. The first process he has developed is shown in the flowchart in **Fig 1**.



For example, using the process in **Fig 1**, Tom Ward's username would be TomWa. State, using the process in **Fig 1**, the username for Rebecca Ellis.

1	a	• RebEI	1	Correct Answer Only (allow any case)
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Johnny has updated the process used to create usernames as follows:

- If the person is male, then their username is the last 3 letters of their surname and the first 2 letters of their first name.
- If the person is female, then their username is the first 3 letters of their first name and the first 2 letters of their surname.

What would be the username for a male called Fred Biscuit using the updated process?

	b	i	<ul style="list-style-type: none"> • UitFr 	1	Correct Answer Only (allow any case)
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Write an algorithm for Johnny to output a username using the updated process.

		ii	<ul style="list-style-type: none"> • Taking firstname, surname and gender as input • Checking IF gender is male / female (using appropriate selection) • For male ... Generating last 3 letters of surname using appropriate string manipulation • ...Generating first 2 of letters of firstname and adding to previous • For female.... correctly calculating as before • Correct concatenation and output <pre> input firstname, surname, gender if gender = "Male" then username = RIGHT(surname, 3) + LEFT(firstname,2) else username = LEFT (firstname,3) + LEFT(surname,2) end if print (username) </pre>	6	<p>1 mark for each correct bullet to a maximum of 6.</p> <p>If used, a flowchart should represent the bulleted steps in the answer column</p>
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QUESTION 2

Heath is researching how long, to the nearest minute, each student in his class spends playing computer games in one week (Monday to Friday). He is storing the data in a 2D array. **Fig 2** shows part of the array, with 4 students.

Fig. 2

		Students			
		0	1	2	3
Days of the week	0	60	30	45	0
	1	180	60	0	60
	2	200	30	0	20
	3	60	10	15	15
	4	100	35	30	45

For example, student 1, on Monday (day 0), played 30 minutes of computer games. Explain why Heath is using an array to store the data.

2	a	<ul style="list-style-type: none"> • Allows multiple items of data to be stored ... • under one identifier / name • Can store a table structure • Reduces need for multiple variables 	2	1 mark for each bullet to a maximum of 2.
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Identify a data type that could be used to store the number of minutes in this array.

	b	i	Integer	1	Any data type that stores a whole number only
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State why this data type is the most appropriate.

		ii	It is a whole number / no decimals / to the nearest minute.	1	
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Heath wants to output the number of minutes student 3 played computer games on Wednesday (day 2). He writes the code: `print(hoursPlayed[3,2])`. The output is 20. Write the code to output the number of minutes student 0 played computer games on Wednesday.

	c	i	print (hoursPlayed[0,2])	1	Correct Answer Only
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State the output if Heath runs the code: `print (hoursPlayed[2 , 1])`.

		ii	0	1	Correct Answer Only
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State the output if Heath runs the code:

`print (hoursPlayed[3 , 1] + hoursPlayed[3 , 2])`.

		iii	80	1	Correct Answer Only
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Write an algorithm to output the total number of minutes student 0 played computer games from Monday (day 0) to Friday (day 4).

		iv	<ul style="list-style-type: none">• Adding all correct elements• Outputting correctly• Using a loop <p>e.g. total = 0 for x = 0 to 4 total = total + hoursPlayed[0,x] next x print (total)</p>	3	1 mark per bullet to a maximum of 3. If used, a flowchart should represent the bulleted steps in the answer column
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Heath has the day of the week stored as a number, e.g. 0 = Monday, 1 = Tuesday. Write a sub-program that takes the number as a parameter and returns the day of the week as a string.

	d	<ul style="list-style-type: none">• Appropriate declaration of a function that takes day number as parameter and returns day• Use of selection (if / switch)• Appropriate comparison• Correct identification of each day• Case default <p>e.g.</p> <pre>function returnDay(dayNo As String) As String switch dayNo case 0: returnDay = "Monday" case 1: returnDay = "Tuesday" case 2: returnDay = "Wednesday" case 3: returnDay = "Thursday" case 4: returnDay = "Friday" case default: returnDay = "Invalid" endswitch endfunction</pre>	5	<p>1 mark per bullet to a maximum of 5.</p> <p>If used, a flowchart should represent the bulleted steps in the answer column.</p>
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Heath needs to work out the average number of minutes spent playing computer games each day for the class, which contains 30 students. Write an algorithm to output the average number of minutes the whole class spends playing computer games each day.

e		<ul style="list-style-type: none"> • Loop 0 to 29 • Loop 0 to 4 • Accessing hoursplayed[x,y] • Addition of hoursplayed[x,y] to total • Calculating average correctly outside of loops • Outputting the results <p>e.g.</p> <pre>total = 0 for x = 0 to 29 for y = 0 to 4 Total = total + hoursPlayed[x,y] next y nextx average = total / (30*5) print (average)</pre>	6	<p>Accept any type of average calculation (mean, median, mode).</p> <p>If used, a flowchart should represent the bulleted steps in the answer column.</p>
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QUESTION 3

The area of a circle is calculated using the formula $A = \pi r^2$, where π is equal to 3.142 and r is the radius. Finn has written a program to allow a user to enter the radius of a circle as a whole number, between 1 and 30, and output the area of the circle.

```
01  int radius = 0
02  real area = 0.0
03  input radius
04  if radius < 1 OR radius > 30 then
05  print ('Sorry, that radius is invalid')
06  else
07  area = 3.142 * (radius ^ 2)
08  print (area)
09  end if
```

Identify **two** variables used in the program.

3	a	<ul style="list-style-type: none"> • radius • area 	2	
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Identify **one** item in the program that could have been written as a constant.

	b	i	<ul style="list-style-type: none">• 3.142• 2• 1• 30	1	Maximum of 1 mark
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Give **one** reason why you have identified this item as a constant.

		ii	<ul style="list-style-type: none">• The number does not need to be changed while the program is running• The number can be updated once and it updates throughout 1 (A01 1a) Maximum of 1 mark	1	Maximum of 1 mark
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QUESTION 4

Julie is writing a computer game that simulates a 100m race. Each time the space bar is pressed, the position of the player moves up by 1. When the position reaches 100, the player has won. Here is Julie's algorithm for the program.

```

CONST PlayerKey = " "
Position = 0
REPEAT
  INPUT KeyPressed
  If KeyPressed = PlayerKey THEN
    Position = Position + 1
  END IF
UNTIL Position = 100
  
```

State an example of a constant and a variable in the algorithm above.

4	a	<ul style="list-style-type: none"> • Constant: PlayerKey • Variable: Position / KeyPressed. 	<p>Must be the identifier only and no additional code</p> <p>?Examiner's Comments??</p> <p>This was generally well answered. Centres should emphasise to candidates that in questions such as these where candidates are asked to identify a particular element from an extract of code, it is important that they give just the element required (in this case only the name of the constant or variable). Giving additional elements of the code (such as a full constant or variable declaration) suggests a lack of understanding and is not credited.</p>
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State what is meant by selection and iteration using examples from Julie's algorithm.

	b	<p>Selection</p> <ul style="list-style-type: none"> • A condition is used to decide whether code should be executed • Position = Position + 1 is only run if the IF condition is met. <p>Iteration</p> <ul style="list-style-type: none"> • code is executed repeatedly • The code in the repeat loop will be run several times (until Position = 100). 	<p>?Examiner's Comments??</p> <p>Candidates who have completed the course will have used iteration and selection extensively as part of their programming, and so it was disappointing that many appeared not to recognise these terms, as they apply to programming, for this question, and made guesses based on the normal everyday meaning of the terms (and hence often getting better marks for iteration). Centres are advised not to teach the theoretical concepts relating to programming (which are assessed in this examination) separately from the programming practice which is assessed in A453, but rather to use their programming lessons as a context to bring this content alive. Again, it would be appropriate here for candidates to learn basic definitions by rote – their understanding of such definitions was tested separately by their being asked to apply them to the algorithm given.</p>
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QUESTION 5

Santos is writing a program that guesses the number of goals a team will score in a football match. The algorithm for his program is shown below.

```

01  CONST Noise = 10
02  INPUT Wins
03  INPUT Losses
04  Goals = 0
05  Net = Wins - Losses
06  WHILE Net > Noise
07    Goals = Goals + 1
08    Net = Net - Noise
09  END WHILE
10  OUTPUT Goals
  
```

State what is meant by a constant and give an example from the algorithm above.

5	a	<ul style="list-style-type: none"> • A value that does not change (while the program is running) • eg Noise 	<p>For the example do not accept the whole line of code; candidate should show that they know where the constant is.</p> <p>Note that “A constant is a variable which does not change” is a contradictory answer (because by definition variables change) and when candidates give a contradictory answer award no marks.</p> <p><u>Examiner's Comments</u></p> <p>Given the good ability shown by candidates to follow the algorithm in (c) and the fact that prior to taking this examination, candidates would have completed the controlled assessment tasks in A453, one would have expected stronger answers for the definitions of constants and variables in (a) and (b) than those seen. Typically vague answers such as “something that does not change” and “something that can change” do not demonstrate to the examiner an understanding of the meaning of these terms in the context of programming as they more closely describe their everyday meaning, and were not awarded any marks. Some candidates stated that “a constant is a variable which does not change” which was considered a self-contradictory answer. Another common mistake was to state that constants and variables were numbers. Also, candidates needed to be more precise when identifying constants and variables in the pseudocode provided by stating the name only. By quoting the whole line in which a constant appears, such as “CONST noise = 10), candidates indicate to the examiner that they either do not know what a constant is, or they do not know precisely where it is in that line of code. In (c) many candidates followed the algorithm correctly and were</p>
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					awarded full marks. Weaker candidates demonstrated a misunderstanding of the abstractions used and seemed distracted by alternative possible meanings of the identifiers in the question, for example by assuming that "Net" means the ball has touched the net and equating it to the number of goals.
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State what is meant by a variable and give an example from the algorithm above.

	b		<ul style="list-style-type: none"> A location in memory to store / a value that may change (as the program is running) eg Wins / Losses/ Net / Goals 	2	
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State the number of goals that will be output by this algorithm for the following inputs. Explain how you obtained your answer in each case.

- Wins = 30 Losses = 25

	c		<ul style="list-style-type: none"> Net = 5 which is less than Noise Goals = 0 	2	<p>1 mark for the subtraction and result of the comparison</p> <p>1 mark for correct result</p>
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- Wins = 20 Losses = 5

			<ul style="list-style-type: none"> Net = 15 which is greater than Noise Runs Loop once {Goals = Goals + 1, Net = Net ? Noise}... Goals = 1 	3	<p>1 mark for the subtraction and result of the comparison</p> <p>1 mark for clearly indicating that the loop is executed once</p> <p>1 mark for correct result</p> <p>Remember to enter a total mark out of 5 for both sections.</p>
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QUESTION 6

When customers pay using a card such as the one below, shops use computer systems to process the payment.

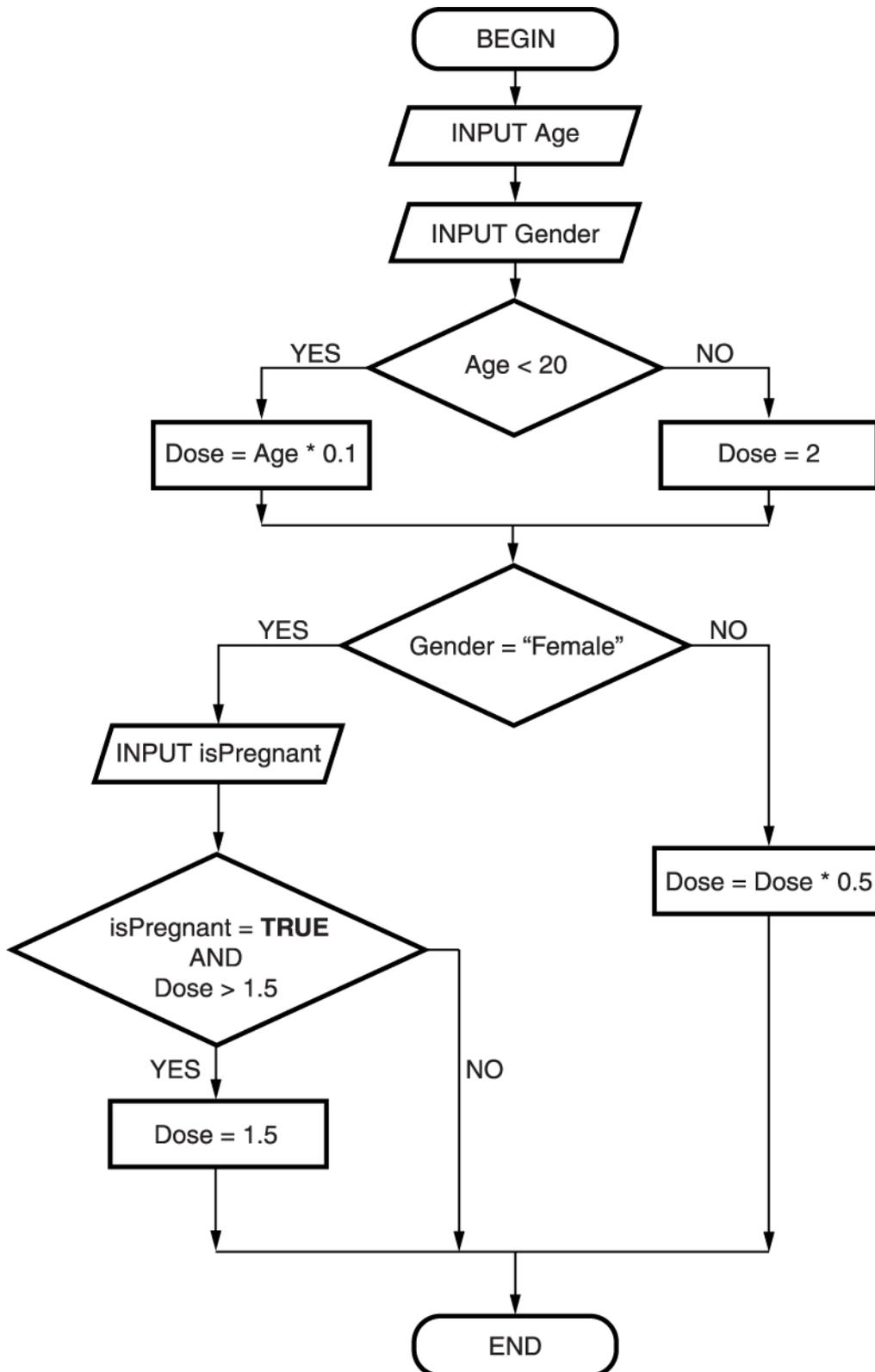


Tick **one** box in each row to show which of the data types given is the most appropriate data type for each of the following data items.

6						1 mark per row
						<u>Examiner's Comments</u>
						3 This part was generally well answered, although a large number of candidates gave Integer as the data type for a customer card number. Centres should ensure that candidates understand the difference between numerical data (integers and real numbers), where it is the numerical value that is significant, and data which happens to be a string of digits and where it is the sequence of digits rather than their value that is significant, such as telephone numbers, PIN codes, ID numbers etc. In this case, an example customer number beginning with 5 leading zeros, was provided to alert candidates of this issue, but this was ignored by many candidates.
	Item of data	Date	Integer	Real	String	
The amount paid			✓			
The customer's card number				✓		
The date of the payment	✓					

QUESTION 7

A computer program calculates the correct dose in grams of a type of medicine. The algorithm used is shown by the flow diagram below.



The data type of the variable Age is Integer. State the data type of the following variables used in the flow diagram.

7			Variable	Data Type	3	Allow known equivalent names of data types: String: alphanumeric / text. Do not accept character but accept an array of character or pointer to character. Real: single, double, float, decimal. Do not accept Number. Boolean: Yes / No, True / False
			Gender	String		
			Dose	Real		
			isPregnant	Boolean		
			1 mark per row			

QUESTION 8

Joseph is an author and programmer, and he needs to estimate how many pages his new book will have. Each page has an average of 300 words. Each chapter starts with a chapter title page. The number of pages is estimated by:

- Dividing the number of words by 300
- Ignoring the decimal part of the division
- Adding the number of chapters to this total

Joseph uses the algorithm below to estimate the number of pages, but his algorithm does not give the correct result.

```

01 INPUT numberOfWords
02 INPUT numberOfChapters
03 CONST wordsPerPage = 300
04 numberOfPages = RoundDown(numberOfWords / wordsPerPage)
05 numberOfPages = numberOfWords + numberOfChapters
06 OUTPUT numberOfPages
    
```

Joseph has used a **RoundDown** function to remove the decimal part of the division, e.g. **RoundDown (6.2)** would return 6, **RoundDown (7.8)** would return 7. State whether this algorithm uses selection, sequence or iteration.

8			Sequence	1	Examiner's	Comments
					This question was appropriate programming theory and	techniques.
					This question was answered well, with many candidates correctly getting sequence. Some candidates did not read the question, and gave a response other than the three options the question gave.	

Line 03 defines a constant. Describe what is meant by a constant.

9	a	<ul style="list-style-type: none"> • A location in memory • The value / contents cannot be changed (whilst the program is running) 	<p>0 mark for "a variable that does not change"</p> <p>0 marks for "stays the same"</p> <p>Examiner's Comments</p> <p>This question was appropriate programming theory and techniques.</p> <p>This question was not answered well by many candidates. Some candidates did not appear to have any understanding of what a constant was, and made a guess based on the English definition of the word. Some candidates did not differentiate between a constant and a variable in their response, saying that the value doesn't change in the program, which could also be the case for a variable. The better candidates were able to correctly identify that it can't be changed.</p>
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Identify the most appropriate data type for the following variable **numberOfWords**. Give a reason for your choice.

	b	<ul style="list-style-type: none"> • Integer / Int • It is a whole number / you can't have half a word 	<p>Do not allow 'need to ignore the decimal' Cannot get reason if data type incorrect</p> <p>Examiner's Comments</p> <p>This question was appropriate programming theory and techniques.</p> <p>This question was answered well by many candidates, who were able to identify the appropriate data type. Many candidates did not know what a data type was, and gave other responses.</p>
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Joseph is changing his algorithm and needs to store the name and price of his new book in new variables. State the most appropriate data type(s) for these variables.

	c	<ul style="list-style-type: none"> • String (name) • Real / Single / Double / Currency / Float / (Decimal) (price) 	2	<p>Examiner's</p> <p>This question was appropriate programming theory and</p> <p>Comments</p> <p>techniques.</p> <p>As with Q.4(d), where candidates knew what a data type as, they were able to give good responses to this question. There was a significant number of candidates who did not know what a data type was. Some candidates did not fully read the question, and gave one data type and then a reason for it.</p>
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QUESTION 9

Charlotte runs a website which stores details about movies. The users can log onto the website and leave ratings for movies. The website uses a database with three tables:

- The table **FILM** contains the following fields; **FilmID**, **Title**, **Year**, **Director**, **Category**
- The table **USER** contains the following fields; **UserID**, **FirstName**, **Surname**, **DateofBirth**
- The table **RATING** stores, amongst other fields, the rating a user has given a film (a score out of 5).

An extract of the data in the table **RATING** is shown below.

RatingID	FilmID	UserID	Rating
00214	16CM12	20_Elliot	4.5
00215	55HR8	Jade01	1
00216	12HR15	Sunil_99	1
00217	16SF8	Jade01	2

Explain why **FilmID** has been included in the **RATING** table.

10		<ul style="list-style-type: none"> • It is a foreign key • It is a Primary Key in FILM • It links to the FILM table / create a relationship to the FILM table • To get details about the film the rating refers to • Do not have to repeat the data / film / rating / reduces data redundancy • 1 film can be given many ratings 	3	<p>It must be clear that foreign key is in the rating table.</p> <p>Examiner's Comments</p> <p>Candidates had a good attempt at this question, with a significant number correctly identifying that it was to identify which film the rating was for. The better candidates were then able to explain how this was set up in the databases, correctly referencing the primary and foreign keys. A common error was that the candidates did not identify which table the PK and FK was in, or which tables were linked.</p>
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Give **one** example of a record that could be stored in the user table.

11	a		One piece of valid data for each of the fields in the user table e.g. J123, Joe, blogs, 1/4/1982	1	<p>Accept any valid / reasonable data for each field Username, First name, Surname, DateOfBirth</p> <p>Examiner's Comments</p> <p>This question was not well answered. Candidates confused record with field, and gave an example of a field from the table.</p>
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Charlotte uses a query to list films. The query uses the following criteria:

(Rating < 2) AND (UserID = "Jade01")

List the RatingID(s) of the rating(s) that will be selected from the extract shown.

	b	i	00215	1	<p>Correct answer only Must have leading 0s 0 marks if any additional</p> <p>Examiner's Comments</p> <p>This question was answered well. Some candidates did not read the question fully, and gave more fields that was being asked for.</p>
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Write the criteria for a query that will select all Films produced in the Year 2015 in the Category **"Comedy"**.

		ii	<p>1 mark per bullet</p> <ul style="list-style-type: none"> • Year = 2015 • AND • Category="Comedy" 	3	<p>Comedy must have speech marks Ignore speech marks around 2015 "ok for" Spellings must be accurate</p> <p>Examiner's Comments</p> <p>The majority of candidates made a good attempt at this question. There were often some minor errors, such as not including the speech marks around the string Comedy.</p>
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