FOR OFFICIAL USE

National Qualifications 2018

Mark

X716/76/01 Computing Science

TUESDAY, 22 MAY
1:00 PM – 3:00 PM

X7167601

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth
Day Month Year

Scottish candidate number

Total marks — 90

SECTION 1 — 20 marks

Attempt ALL questions.

SECTION 2 — 70 marks

Attempt ALL questions.

Show all workings.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

SQA ©

X7167601 01

MARKS | DO NOT WRITE IN THIS MARGIN

SECTION 1 — 20 marks

Attempt ALL questions

1. Convert the number −120 into 8 bit two's complement. **1**

Comp Sys

2. Explain the difference between a public key and a private key when securing the transmission of data. **2**

Comp Sys

3. Facts are a feature of a declarative language. An example is shown below:

NA

```
sibling(fred, senga).
```

Name and describe one other feature of a declarative language. **2**

NA

4. Disk mirroring (RAID) is a backup strategy used to create a second copy of data in real time.

Describe two drawbacks of using mirroring (RAID) as a backup strategy. **2**

Comp Sys

5. Character sets can be represented using either ASCII or Unicode.

Describe an advantage of using Unicode over ASCII, making reference to the number of bits used to represent a character in each format. **2**

NA

6. A database designer may have to make use of a surrogate key.

Explain what is meant by the term surrogate key. **2**

[Turn over

SDD

7. The incomplete function shown below performs a linear search to find the position of the target item in the following array of strings.

Meena	Sean	Gianni	Ali	Nyah	Lynn

When Meena is entered as the target item then 0 is returned. If Lynn is entered as the target item then 5 is returned.

```
Line 1  FUNCTION linearSearch(ARRAY OF STRING list)RETURNS
        INTEGER
Line 2    DECLARE index INITIALLY -1
Line 3    DECLARE position INITIALLY -1
Line 4    DECLARE target AS STRING INITIALLY FROM KEYBOARD
Line 5    REPEAT
Line 6      SET index TO index+1
Line 7      IF target=list[index] THEN
Line 8       SET _____________________________
Line 9      END IF
Line 10   UNTIL <end of list> OR    _____________________________
Line 11   RETURN position
Line 12 END FUNCTION
```

(a) Complete lines 8 and 10 below. **2**

Line 8 `SET` _____

Line 10 `UNTIL <end of list> OR` _____

(b) State the value that would be returned by the function if the target item was not in the list. **1**

_____

8. Machine code instructions are fetched from memory and executed by the processor.

Comp Sys

Complete the missing steps of the fetch-execute cycle in the table below. **2**

1.	The processor places the address of the instruction on the address bus.
2.	
3.	
4.	Instruction is decoded and executed.

9. The increased use of cache memory is one trend that improves the performance of modern computer architecture.

Comp Sys

(a) State one other trend that improves performance. **1**

(b) Describe how your answer to part (a) improves performance. **1**

[Turn over

NA

10. John has downloaded a new computer game but finds that it does not run on his computer.

(a) State one software reason why the game may not be compatible. **1**

_____

(b) State one hardware reason why the game may not be compatible. **1**

_____

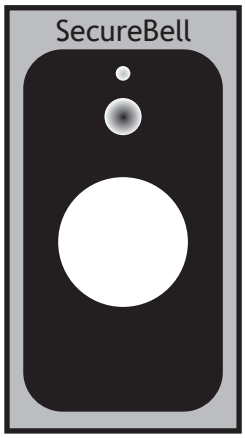
[END OF SECTION 1]

SECTION 2 — 70 marks

Attempt ALL questions

11. SecureBell is a company that manufactures an Internet enabled doorbell which can be accessed using a smartphone. The doorbell has a video camera, which allows the customer to see, hear and speak with anyone arriving at their front door.

NA



(a) SecureBell stores customer videos on a public cloud.

(i) State two reasons why SecureBell chooses to use a public cloud rather than a private cloud to store the videos. **2**

(ii) Customers may have concerns about the security of video being stored on the public cloud.

State two precautions used to ensure security of data on public cloud storage. **2**

MARKS

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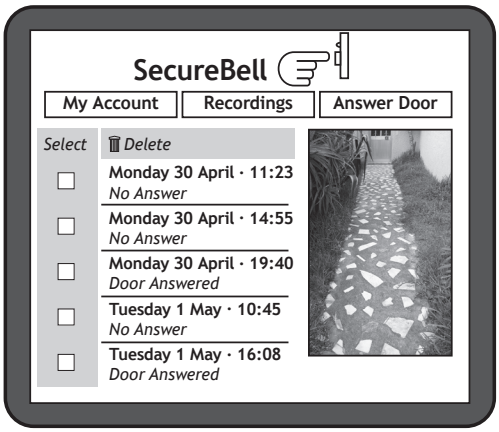
NA

(b) State two implications of the Regulation of Investigatory Powers Act (RIPA) for SecureBell. **2**

(c) When the doorbell is pressed, the camera captures video with a resolution of 1920 pixels by 1080 pixels, 65 536 colours and a frame rate of 24 frames per second.



(i) Calculate the size of the first frame captured. Express your answer in bits. **2**

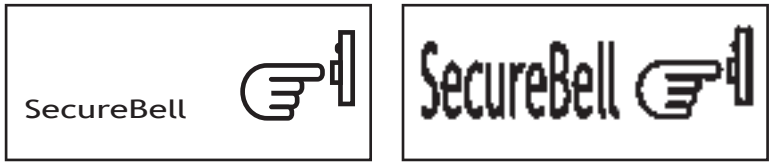
(ii) This first frame is compressed using intraframe compression.

Describe how interframe compression is also used to reduce the file size of the video. **2**

11. (continued)

NA

(d) SecureBell is considering changes to their logo and have edited it as shown below.



Original logo Edited logo

Comp Sys

(i) State whether the logo was created in a vector or a bitmap package. Explain your answer. **2**

NA

(ii) Explain how Run Length Encoding would compress this image. **2**

[Turn over

SDD

12. A new app is being developed for movie fans.

MARKS DO NOT WRITE IN THIS MARGIN

(a) The developers of the app are using agile methodologies. They employ usability testing as part of this.

Describe how usability testing influences the development of the app. **3**

(b) The app will have information on the top 100 movies of all time including the studio that made the movie, fan ratings and takings at the box office. For example:

Title	Studio	Rating (out of 100)	Takings ($m)
The Matrice	Nightworks	85	6.7
The Home Route	Gateway	42	0.4
Freezing	Aurora	95	12.5
....	.....	.....	.....

(i) Using pseudocode or a programming language of your choice, define a suitable record data structure for the movie data above. **2**

12. (b) (continued)

SDD

(ii) Using pseudocode or a programming language of your choice, declare the variable which can store the details of the top 100 movies.

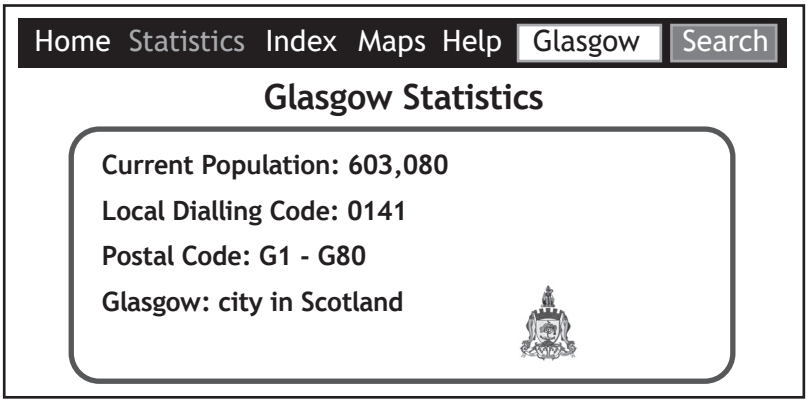
Your answer should use the record data structure created in part (i). **2**

(c) Using pseudocode or a programming language of your choice, write an algorithm which:

- asks for a studio name
- totals the number of movies that the studio has in the top 100
- saves the studio name and total to file. **6**

13. A tourist website has a web page which displays statistics about towns and cities. The user enters a name in the text box and clicks on the search button to display the statistics.

WDD



NA

(a) Explain why server-side scripting has been used to produce the statistics as shown on the web page above. **1**

(b) The website makes use of Cascading Style Sheets (CSS)

WDD

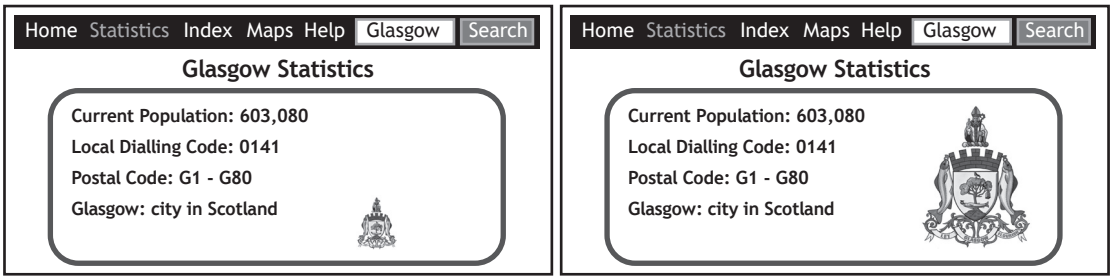
(i) The text 'Glasgow Statistics' is an H1 heading. Write a CSS rule that makes H1 headings appear in Arial, centre aligned and green. **3**

(ii) Describe how CSS rules should be implemented to ensure that all of the web pages on the website have consistent formatting. **2**

13. (continued)

WDD

(c) When the user places their mouse on the image of Glasgow's coat of arms it increases in size as shown below. When the mouse is moved away from the image, the image returns to its normal size.



Complete the four missing lines of code to allow the:

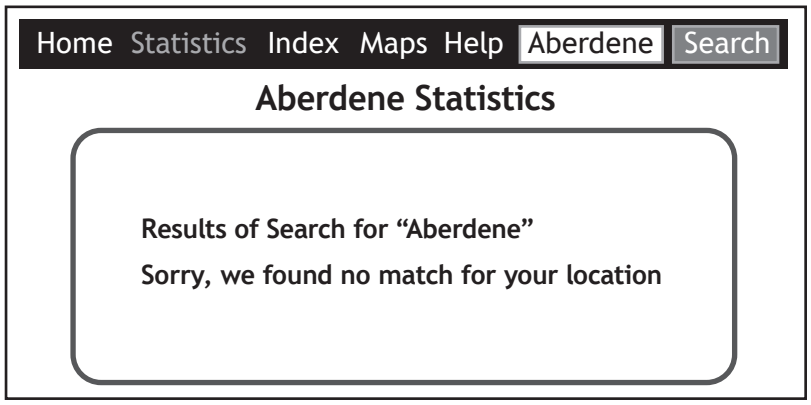
- Function Increase() to triple the width and height of the graphic when the user moves the mouse pointer over the image
- Function Normal() to return the image to its original size when the user moves the mouse pointer off the image. **3**

```
<!DOCTYPE html>
<html>
<body>

<img
onmouseover="Increase(this)"
onmouseout="_________________"
src="Glasgow.png"
width="32" height="32">

<script>
function Increase(x) {
    x.style.width = "96px";
    _________________
}

function Normal(x) {
_________________

_________________
}
</script>

</body>
</html>
```

13. (continued)

NA

(d) The user tries to find statistics for Aberdeen. However, they typed "Aberdene" into the text box and the following web page was displayed.



Explain how this database-driven website uses server-side scripting to produce the output above. **4**

[Turn over for next question

DO NOT WRITE ON THIS PAGE

14. GlenSki offers one-to-one skiing lessons at a number of ski resorts in Scotland.

DDD

Instructors are based at a resort, and customers can book several lessons on one day.

A relational database is used to store data as follows:

Customer	**Lesson**	**Resort**	**Instructor**
CustomerID	InstructorID*	ResortID	InstructorID
FirstName	StartTime	Name	FirstName
Surname	Date	Postcode	Surname
ContactNumber	Duration	Lifts	ResortID*
EmailAddress	CustomerID*		

(a) Draw an entity relationship diagram to show the relationships that exist in this database. **3**

14. (continued)

DDD

(b) State the primary key used to uniquely identify the Lesson table. **1**

(c) The following report was generated to show an instructor a list of the lessons that they will deliver on a specific date.

GlenSki 17/12/18 Instructor: 14

Daily Schedule Chris, your lessons today are:

Rafal Avila	9.00 am
Martin Iskra	11.00 am
Daniella Smith	12.15 pm
Rafal Avila	3.00 pm

Number of lessons: 4

State the tables and fields needed to output the above report. **3**

14. (continued)

DDD

(d) The report was based on the result of a query.

State the criteria used to select the data shown in the report. **2**

NA

(e) State the report feature that has been used to display the 'Number of lessons' shown as part of this report. **1**

(f) GlenSki wants to expand their business worldwide.

Describe one potential business cost of scaling their information systems. **1**

(g) GlenSki encourages customers to participate in an online community.

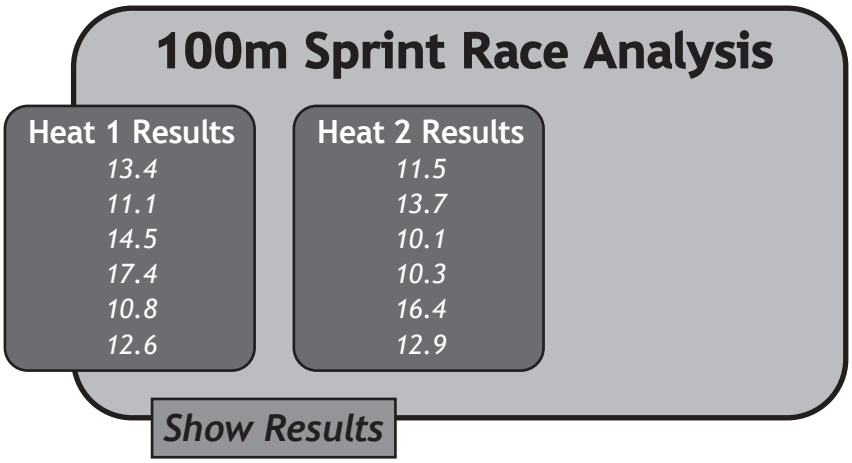
Describe one benefit to customers of joining an online community. **1**

[Turn over for next question

DO NOT WRITE ON THIS PAGE

15. SportsStats is a program that processes the results of athletics competitions. The results of two different heats are compared to find which heat had the fastest time.

SDD



When a user presses the 'Show Results' button, the program should output the number of the heat that had the fastest runner, for example:

"The fastest runner ran in heat 2"

The program makes use of the following function:

```
Line 1    FUNCTION fastest_time(ARRAY OF REAL list) RETURNS REAL
Line 2       DECLARE min INITIALLY list[0]
Line 3       DECLARE upper INITIALLY length(list[])
Line 4       FOR index FROM 1 to (upper-1) DO
Line 5         IF min < list[index] THEN
Line 6           SET min TO list[index]
Line 7         END IF
Line 8       END FOR
Line 9       RETURN min
Line 10   END FUNCTION
```

The function is used in the following section of code:

```
...
Line 21   SET heat1 TO [13.4, 11.1, 14.5, 17.4, 10.8, 12.6]
Line 22   SET heat2 TO [11.5, 13.7, 10.1, 10.3, 16.4, 12.9]
Line 23   SET first_result TO fastest_time (heat1)
Line 24   SET second_result TO fastest_time (heat2)
Line 25   IF first_result < second_result THEN
Line 26      SEND "The fastest runner ran in heat 1" TO DISPLAY
Line 27   ELSE
Line 28      SEND "The fastest runner ran in heat 2" TO DISPLAY
Line 29   END IF
...
```

15. (continued)

SDD

(a) Explain why line 4 of the function contains the limit `(upper-1)`. **1**

(b) Describe how the parameters are used when executing line 23.

Your answer should identify the formal and actual parameters. **3**

(c) State the scope of the `min` variable. Explain your answer. **2**

(d) Testing reveals an error in the function. The function is first called during execution of line 23 of the main program.

In order to identify this error, a watchpoint has been set to show the value of the `min` variable each time it is changed.

Complete the table to show the values that would be shown when this watchpoint is triggered. **3**

Function Line	min
2	
6	
6	

15. (continued)

SDD

(e) Testers report that the program sometimes outputs the incorrect result.

(i) Identify the error in the function that causes incorrect output. **1**

(ii) State the type of error that has caused this issue. **1**

(iii) Explain why the incorrect code outputs the correct statement.

Your answer should make reference to the original heat results shown on lines 21 and 22 of the code. **2**

15. (continued)

SDD

(f) If the fastest time in heat 1 and heat 2 is the same, the following output is always displayed:

```
"The fastest runner ran in heat 2"
```

(i) Explain this output with reference to the conditional statement beginning at line 25. **2**

(ii) Explain how the code could be altered to include a third option which will state:

```
"Both heats have the identical fastest time"
```
1

(g) Explain the role of the memory management function of the operating system when a user loads the SportsStats program. **2**

[END OF QUESTION PAPER]

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ACKNOWLEDGEMENTS

Question 11 (c) – Anastasiia Makarova/Shutterstock.com