FOR OFFICIAL USE

National Qualifications 2017

Mark

X716/76/01 Computing Science

TUESDAY, 16 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

SECTION 1 — 20 marks

Attempt ALL questions

MARKS | DO NOT WRITE IN THIS MARGIN

1. State the range of positive and negative numbers that can be represented using 16 bit two's complement representation. **2**

Comp Sys

2. Describe the analysis stage of the software development process. **2**

SDD

3. A stereo sound file lasting 2 minutes with a sample rate of 96 kHz and sample depth of 16 bits is stored on a computer.

NA

Calculate the storage size of the uncompressed sound file.

Show all working and express your answer in appropriate units. **3**

MARKS | DO NOT WRITE IN THIS MARGIN

4. Tables within a database can make use of compound keys and surrogate keys.

NA

Explain the difference between a compound key and a surrogate key. **2**

5. Tracking cookies can be created and used when browsing a website.

Comp Sys

Describe a security risk associated with tracking cookies. **1**

6. Customers log into their bank account using a username, PIN and password.

Comp Sys

Explain how public and private keys help to keep these details secure when transmitted between the customer and the bank's server. **2**

7. There are many disabilities or impairments that can be a barrier to effective computer use.

NA

(a) Visual impairments could be overcome by using large fonts.

State one other feature that could help a person with a visual impairment. **1**

(b) Hearing impairments could be overcome by adjusting the speaker volume.

State one other feature that could help a person with a hearing impairment. **1**

8. Describe how object-oriented languages are used to create software. **2**

NA

SDD

9. A programmer is creating a program to store details about books. The details stored are: title, author, number of pages and price.

(a) Create, using pseudocode or a language with which you are familiar, a record structure to store the book details. **2**

(b) Declare, using pseudocode or a language with which you are familiar, a variable that can store the data for 1000 books. **2**

[END OF SECTION 1]

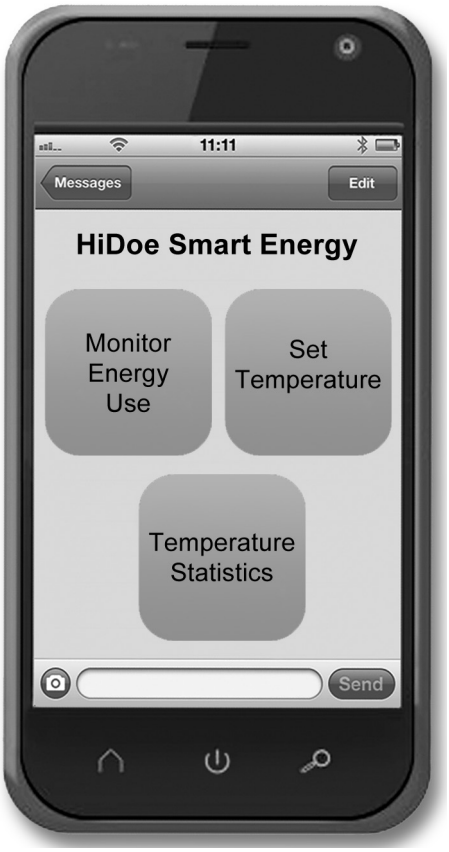
[Turn over

SECTION 2 — 70 MARKS

Attempt ALL Questions

10. HiDoe manufactures intelligent heating control systems that allow users to monitor the temperature in different rooms in their house. An app can be downloaded to access information about energy use.

SDD



Selecting **Temperature Statistics** on the app allows users to see the highest and lowest temperature of a room over the course of a 24 hour period.

A sensor measures the temperature in a room at the start of each hour in a day. These temperatures are stored in an array called `temps`.

index	0	1	2	3	.....	22	23
temps	10	8	12	11	.....	14	13

10. (continued)

SDD

(a) The temperature statistics feature displays the message:

The lowest temperature was 8 Celsius at hour 1.

Write, using pseudocode or a language with which you are familiar, an algorithm that can:

- find the lowest temperature
- display the message shown above
- write the lowest temperature to an external file called "low.txt". **7**

NA

(b) Name a function of the operating system and describe one task it will perform when creating the external file. **2**

10. (continued)

SDD

The app makes use of a function to calculate the average.

```
Line 1  FUNCTION calcAverage (ARRAY OF INTEGER list) RETURNS INTEGER
Line 2      DECLARE total AS INTEGER INITIALLY 0
Line 3      DECLARE average AS INTEGER INITIALLY 0
Line 4      FOR index FROM 0 TO 23 DO
Line 5          SET total TO total + list[index]
Line 6          SET average TO total / (index +1)
Line 7      END FOR
Line 8      RETURN average
Line 9  END FUNCTION
```

MARKS DO NOT WRITE IN THIS MARGIN

(c) At the end of the first iteration, the values for total and average are both 10.

(i) Complete the following trace table to show the values of the total and average variables at the end of the ***second and third iteration*** of the loop. **2**

End of Iteration	Total	Average
1	10	10
2		
3		

(ii) On the fourth iteration, a runtime error occurs. Error reporting states that line 6 is the cause.

Explain why this line causes the problem and how to correct it. **2**

10. (continued)

SDD

(d) The calcAverage function only works for 24 integers.

Describe how the function could be altered to calculate the average for any size of list. **1**

Comp Sys

(e) Describe two ways that intelligent heating systems such as HiDoe can be used to reduce the carbon footprint of homes. **2**

[Turn over

DDD

11. Super Taxi allows users to book taxis from their smartphones. Super Taxi uses a relational database to keep a record of their cars, drivers, bookings and customers.

Each driver can only drive one car but the same car can be used by more than one driver. The cost is set at the time of booking.

Car	**Driver**	**Booking**	**Customer**
Registration	Driver ID	Booking ID	Customer ID
Make	First Name	From	Known As
Model	Surname	To	Card Number
Licence Expires	Mobile	Cost	Expiry Date
	Registration*	Driver ID*	Authorisation Code
		Customer ID*	

(a) Draw an entity relationship diagram to show the relationships between the four tables. **3**

DDD

(b) A query is used to generate the report shown below. This report is displayed on a customer's smartphone once a booking is confirmed.

(i) State the tables and fields needed to generate the above report. **3**

(ii) State the search criteria that would identify this booking. **1**

11. (continued)

WDD

The following is an extract from the source code used to generate Super Taxi's homepage.

```
<!DOCTYPE html>
<html>
    <head>
        <title>Super Taxi</title>
    </head>

    <body>

    <h1  id="welcome" onmouseover="mouseOver()"
        onmouseout="mouseOut()">Welcome to Super Taxi</h1>

    <script>
        function mouseOver() {
            document.getElementById("welcome").style.color = "yellow";
        }
        function mouseOut() {
            document.getElementById("welcome").style.color = "black";
        }
    </script>

    </body>
</html>
```

(c) Explain, making reference to the code shown above, what happens when a user places the mouse pointer over the heading "Welcome to Super Taxi". **2**

(d) Meta tags can be used in this webpage.

Insert the missing components of the following meta tag:

<meta _____="keywords" _____="super, taxi"> **2**

11. (continued)

WDD

(e) Search engine providers realised that web developers were placing large numbers of keywords in meta tags to improve a website's ranking in search results. This means that meta tags are often ignored by search engines.

Describe two techniques that search engines use to ensure more relevant results are returned. **2**

(f) The following line of code is added to the homepage:

```
<link rel="stylesheet" type= "text/css" href= "superstyle.css">
```

State the section of the code in which this line should be placed. **1**

(g) Describe the effect on efficiency of web page load times when comparing external and internal CSS. **2**

SDD

12. A program is used to calculate parking charges for a public car park.

The arrival and departure times are converted to and stored as real numbers, for example: 06:30 hours will be converted to and stored as 6.5.

Welcome to Shore Car Park	
CHARGES	**all charges include VAT**
UP TO 1 HOUR	**£2·75**
UP TO 2 HOURS	**£4·25**
OVER 2 HOURS	**£6·25**

The function below is used to calculate the cost of parking for each car.

```
Line 1    FUNCTION calcCost(REAL departure, REAL arrival) RETURNS REAL
Line 1        DECLARE hours_parked INITIALLY 0
Line 3        DECLARE parking_charge INITIALLY 0
Line 4        SET hours_parked TO departure – arrival
Line 5        IF hours_parked <= 1 THEN
Line 6            SET parking_charge TO 2.75
Line 7        ELSE
Line 8            IF hours_parked <=2 THEN
Line 9                SET parking_charge TO 4.25
Line 10           ELSE
Line 11               SET parking_charge TO 6.25
Line 12           END IF
Line 13       END IF
Line 14       RETURN parking_charge
Line 15   END FUNCTION
```

This function is called using the line below:

```
SET cost TO calcCost (arrived, left)
```

MARKS | DO NOT WRITE IN THIS MARGIN

(a) Identify a formal parameter used in the code above and explain what is meant by a formal parameter. **2**

12. (continued)

SDD

(b) A car arrived at the car park at 10:00 and left at 13:00.

When the function is called, arrived has the value 10.0 and left has the value 13.0. The function returns an incorrect cost of 2.75.

Explain why this function did not return the expected value. **2**

(c) Watchpoints are often used during testing.

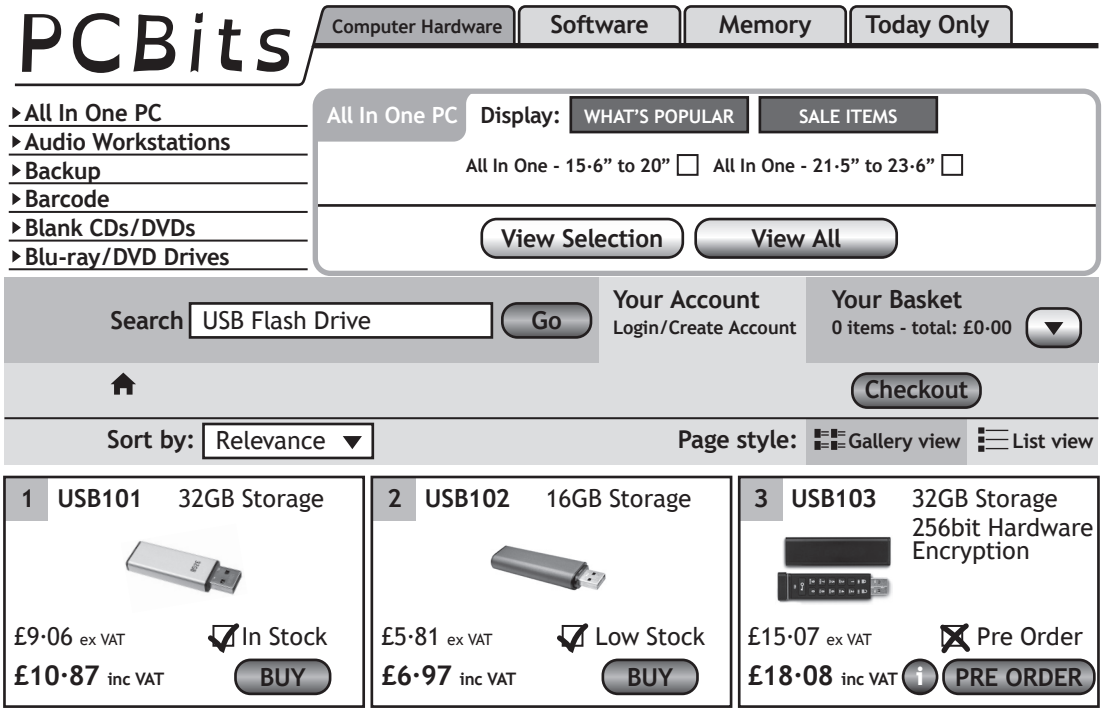
Describe how watchpoints are used to help programmers locate errors. **2**

(d) The function makes use of a local variable.

Describe two benefits of using local variables. **2**

13. PCBits is an online shopping site which sells computer hardware and software.

WDD The diagram below shows a proposed version of their new website.



(a) Describe the process of usability testing of the new website. **2**

(b) The website uses both client-side scripting and server-side scripting. Identify one part of the above website generated using client-side scripting. **1**

13. (continued)

NA

(c) Explain how the use of a database driven website would allow the PCBits website to display a message stating whether items are In Stock, Low Stock or available for Pre-Order. **3**

(d) PCBits is concerned about a loss of data such as customer details and orders.

(i) Describe a suitable backup schedule for PCBits. Your answer should include a description of the type of backup. **2**

(ii) Describe one other strategy that could be used to protect against a loss of data. **1**

13. (continued)

WDD

(e) The code for one of the webpages is shown below:

```
<!DOCTYPE html>
<html>
        <head>
                <style>
                        p{color:red; text-align: center}
                </style>
        </head>

        <body>
                <p> Welcome To </p>
                <p style="color:blue; font-size:200%;"> PCBits</p>
                <p> Glasgow </p>
        </body>
</html>
```

Describe the output from this code. You may use a labelled diagram to support your answer. **2**

14. Catherine runs CraftyBella, an online business promoting arts and crafts.

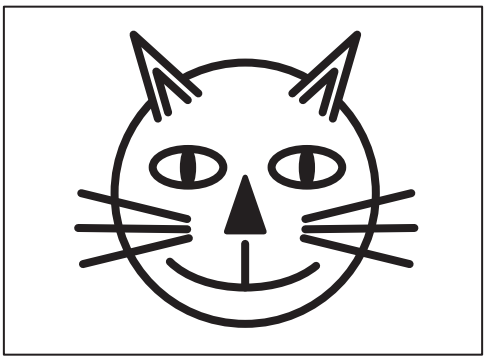
NA

(a) Catherine is concerned that the business data stored on the public cloud is not secure.

Explain why this is **not** the case. **2**

Comp Sys

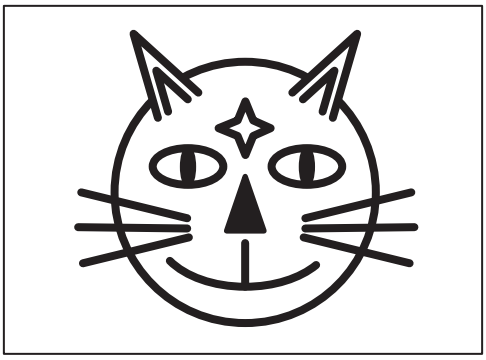
(b) Catherine has designed a black and white logo. There is both a bitmapped and vector graphic of the logo shown below.



(i) Catherine wants to move the ears of the cat closer together. State whether this task is easier to do with the bitmapped or the vector graphic. Explain your answer. **2**

NA **14. (b) (continued)**

(ii) Describe the effect on the file size of adding the star to both the vector **and** bitmapped graphic. **2**



15. A manufacturer of mobile phones is considering the SnapLizard processor. A description of the SnapLizard is given below.

Comp Sys

> The SnapLizard processor has a clock speed of 2·4 GHz. It is quad core, resulting in extremely efficient multi-tasking when compared to dual core processors. The data bus and the address bus are both 32 bits. The SnapLizard includes a separate instruction and data cache.

(a) The processor runs the machine code version of an application by fetching and executing instructions from memory. Describe the steps of the fetch-execute cycle. **3**

(b) The SnapLizard includes cache for instructions and data.

(i) Explain how cache improves performance. **2**

[Turn over

15. (b) (continued)

NA

(ii) The SnapLizard has many registers including X and Y registers. Here are three low level language instructions that are fetched and executed in sequence:

1	LOAD X, 2000	Loads the contents of memory location with address 2000 into the X register.
2	LOAD Y, 2000	Loads the contents of memory location with address 2000 into the Y register.
3	ADD X, Y	Add the contents of the Y register to the X register.

Explain the impact of cache on the execution of instructions 2 and 3. **2**

(c) The mobile phone should be capable of capturing high quality video.

One characteristic that would be considered would be bit depth. Describe the difference between a bit depth of 16 bits and that of 24 bits for the quality of video. **2**

15. (continued)

NA

(d) (i) Describe how video is compressed using interframe and intraframe compression. **2**

(ii) The effectiveness of video compression can depend on the content that is being captured. For example, videoing someone sitting singing a song on stage will compress differently when compared to videoing a high energy dance performance with a group of dancers.

Explain the effectiveness of interframe compression for these different performances. **2**

[END OF QUESTION PAPER]

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