H

National
Qualifications
EXEMPLAR PAPER ONLY

Mark

EP09/H/01

Computing Science

Date — Not applicable

Duration — 2 hours

EP09H01

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 ©

1. The following section of code represents some information about flights:

```
direct(glasgow, london).
direct(london, paris).
direct(paris, rome).
direct(paris, seville).
direct(rome, berlin).

fly_direct(P,Q):-direct(P,Q).
one_stop(X,Y):-fly_direct(X,Z),fly_direct(Z,Y).
```

   (a) State which type of language is shown.

   1

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   (b) Describe two features of this type of language. You may refer to the code in your answer.

   2

   _____

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2. Before a customer can register with the website, they must complete an optical character recogniser code to verify that the user is human.

   (a) Validation of this code entered requires a script. Explain why this script would require server-side processing, rather than client-side processing.

   2

   _____

   _____

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   (b) Explain one feature of the code interface that ensures it can be used by as many people as possible.

   2

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3. State the decimal value of the largest whole number that can be stored using 10-bits.

1

_____

4. Describe two differences between main memory and cache memory.

2

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5. The Scottish Tennis Association stores details about players and clubs in a single table. Below is a record from this table:

Name	Paul Notman
Rating	6·2
Tennis club	Strathmore
Club secretary	Marta Barowska
Club address	67 Greenfield Street, Falkirk
Club telephone	01789 786532

(a) A new club secretary has been appointed for the Strathmore tennis club. Explain why changing the name in this record would be problematic.

2

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(b) Explain how this problem could be solved.

2

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6. Ali has created a poster using bitmapped graphic software. Describe how a colour bitmapped graphic is stored.

2

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7. BestPals is a social networking website. Members can post comments and images on their own pages and on their friends' pages. Members of BestPals can also send private messages to their friends.

(a) Describe one possible social implication of using private messaging in this context.

1

_____

_____

(b) Describe one possible legal implication of using private messaging in this context.

_____

_____

1

8. A list of eight scores for a game is stored in a 1-D array as shown below:

Index	0	1	2	3	4	5	6	7
Scores	16	12	19	20	17	8	13	19

An algorithm will ask for a target score and then find all the scores in the array and reduce them by 10. For example, if the target score entered is 19, then the array becomes:

Index	0	1	2	3	4	5	6	7
Scores	16	12	9	20	17	8	13	9

Part of the algorithm is shown:

```
1   SET scores TO [16,12,19,20,17,8,13,19]
2   RECEIVE target FROM (INTEGER)KEYBOARD
3   FOR counter FROM 0 TO 7 DO
4   IF .............
5     ...................
6   END IF
7   END FOR
```

Using pseudocode, or a language with which you are familiar, complete the missing lines of code at lines 4 and 5.

2

SECTION 2 — 70 marks

Attempt ALL questions

9. A social networking website stores information about its members. The table below shows a sample of the information stored:

Surname	Forename	Username	Password
Walker	Andrew	andypandy	5654
Anderson	Eilish	ellie34	1457
Khan	Ganesh	ganeshk	1457
Anderson	Kevin	kev67	4789
Gallagher	Paul	pg88	2564
Anderson	Shona	shaza	7312
Khan	Zahra	zahrak	1958

(a) A record data structure is used for the members' details.

```
Record Members IS    {STRING surname,
                       STRING forename,
                       STRING username,
                       INTEGER password}
```

Describe how the website could store the information for five million members, using the record data structure above.

2

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_____

_____

9.   (continued)

(b) When someone logs on, a search is performed using the **Username** that they entered.

(i) Using pseudocode, or a language with which you are familiar, write an algorithm that asks for a **Username** and then finds the position of that **Username**.

5

(ii) When implementing code, a programmer can limit the scope of a variable. Explain what is meant by scope and how it can be limited.

2

(iii) A test plan is to be constructed for the search algorithm. kev67 is an example of normal test data that will be used to test the search algorithm.
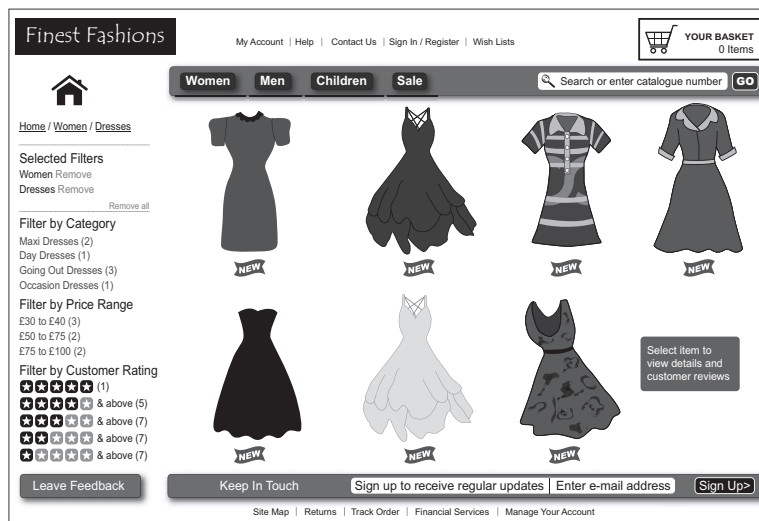
Describe two examples of other types of test data that should be used in this test plan.

2

10. Finest Fashions is an online fashion store. Customers can browse the company website, search for items of clothing and make online purchases.

The screen shot below shows one page from the Finest Fashions website:

(a) All images on the website have been stored as bitmaps of integers, corresponding to the colour of each pixel. Part of an algorithm used to compress the images is shown below:

```
1     SET pixelPrev TO " "
2     SET runLength TO 0
3     SET counter to 0
4     REPEAT
5       RECEIVE pixelColour[counter] FROM
        (INTEGER)file1
6       IF pixelPrev ≠ pixelColour[counter] THEN
7           SEND pixelColour[counter] TO file2
8           SEND runLength TO file2
9           SET pixelPrev TO pixelColour[counter]
10          SET runLength TO 0
11      END IF
12      SET counter TO counter + 1
13      SET runLength TO runLength + 1
14      END IF
15    UNTIL end of file1
```

Explain whether this compression algorithm is lossy or lossless, by making reference to the line numbers shown above.

2

10. **(continued)**

(b) The website allows customers to leave ratings of 1 to 5 stars for any items purchased. As each rating is received, a server-side script is used to recalculate the average rating for the item and then update the average rating displayed on the website.

 Rating: 3.5

The web server stores the total number of ratings received for each item, along with the overall average rating for each item.

Using pseudocode or a language with which you are familiar, write an algorithm for this script.

4

(c) When a customer using the site proceeds to the checkout, the following warning message is displayed:

10. **(c)** **(continued)**

(i) Should the customer proceed? Explain your answer.

    2

_____

_____

_____

(ii) The website is hosted using public web server provision. Explain why moving the website to private web server provision can improve the security of the site.

    2

_____

_____

_____

(d) Finest Fashions decides to make its website available on mobile devices such as smartphones. As a result of this decision, maintenance must be carried out.

Explain **one** modification to the interface that will be necessary, due to the technical limitations of smartphone devices.

    2

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11. A function used to perform an arithmetical operation is shown below:

```
FUNCTION combinations (INTEGER number) RETURNS INTEGER
    SET factor TO 1
    FOR counter FROM 1 TO number DO
        SET factor TO counter * factor
    END FOR
    RETURN factor
END FUNCTION
```

(a) State the formal parameter in the function.

1

_____

(b) A program has two variables called *items* and *permutations* which contain the values 3 and 0 respectively, as shown below:

items		permutations
3		0
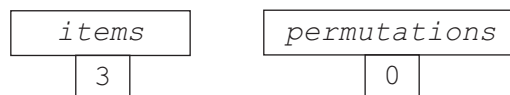
(i) Explain what is meant by an actual parameter, by referring to the following line of code used to call the function above:

SET permutations TO combinations(items)

2

_____

_____

_____

(ii) State the values contained in *items* and *permutations* after execution of the line of code in part (i).

2

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_____

_____

11. **(b)** **(continued)**

(iii) Explain your answer to part (ii).   **3**

_____

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_____

(c) Initial testing of the function showed that it contained a logic error. This logic error was corrected.

(i)   Use an example to explain how a logic error could occur by changing one line of code.   **2**

_____

_____

_____

(ii) Describe one other type of error that may occur when coding.   **2**

_____

_____

_____

12. Carter's Carriage is a transport company which operates a fleet of vans carrying goods between 25 depots throughout the country. Every trip follows one of a number of set routes between an origin depot and a destination depot.

Refuelling, if necessary on longer routes, is only permitted at a particular town on the route.

A relational database has been created to help the company. The structure of the data model is as follows:

Driver	**Trip**	**Van**	**Route**
Driver number	Driver number*	Registration number	Route number
Driver name	Registration number*	Capacity	Origin
Mobile number	Date	Date purchased	Destination
	Route number*		Refuel town

(a) Draw an entity relationship diagram to represent this data model. **2**

(b) Explain the term "compound key" using the above data to exemplify your answer. **2**

_____

_____

_____

12. (continued)

(c) The data dictionary below represents the Trip entity.

State a suitable entry for each of the missing values A to D.

Attribute	Data type	Validation	Unique	Key
Driver number	Integer	Lookup from Driver table	N	PK/FK
Registration number	A	Lookup from Van table	N	PK/FK
Date	Date		C	PK
Route number	Integer	B	N	D

4

_____

_____

_____

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(d) It was suggested that "Refuel town" could have been used instead of "Route number" as a primary key in the Route table. Explain why this would have caused problems.

2

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_____

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13. An app is being developed to view video clips of sporting events such as the 2014 Commonwealth Games and will run on a wide range of smartphones.

During the development process, the developers produce the wireframes shown below:

Sports Selection screen   **Play Video screen**

(a) Describe how the wireframes are used during the software development process.

2

_____

_____

_____

(b) The interface of the app must take account of the needs of all users.

Explain how the presence of novice and expert users will increase the complexity of the development task.

2

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_____

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13. **(continued)**

(c) Once in use, the Sports Selection screen will send the selected sport to the web server and suitable video clips will then be returned to the smartphone. The developers of the app are considering the use of distributed storage for the video clips.

(i) State one benefit of distributed storage for the app developers.

1

(ii) State one benefit of distributed storage for the users of the app.

1

(d) Many smartphones use the Vortex processor. In February 2014 an updated version of the Vortex processor was released. Read the following information about the new processor.

> The 32-bit Vortex-A17 will replace the aging Vortex-A9. The scalable design can support up to four cores, running at speeds of 2GHz and beyond. It will provide up to 60% greater performance than a Vortex-A9 chip, but use 20% less power. The Vortex-A17 processor offers configurable caches, with sizes between 32 KB and 64 KB for instruction, and 32 KB for data.

(i) Explain how the use of cache can improve the user's experience of the Commonwealth Games app.

2

(ii) It is expected that the next release of Vortex processors will introduce the 64-bit Vortex-A50.

Explain why the improvement from 32-bit cores to 64-bit cores will improve the performance of any smartphone, based on these ARM processors.

2

13. (d) (continued)

(iii) Explain how this trend towards increased processor performance impacts on the lifetime carbon footprint of a smartphone.

2

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(iv) Many owners of a smartphone sign up to the online forum run by the manufacturer of the device.

State **two** benefits to smartphone owners of using this type of online community.

2

_____

_____

_____

14. Deeper Blue Sea is a company selling diving equipment. A section of a page from the company's website is shown below:

Part of the HTML code used to produce this page is shown below:

```
1. <head>
2.      <title>Blue Magic Mask<    A    >
3.          <style>
4.                  p.style1{font-size: 9pt;}
5.                  h1{font-family:Verdana, Arial, Helvetica;}
6.          </style>
7. <  B  >
8. <  C  >
9.      <h1>Deeper Blue Sea Diving Equipment Sale!</h1>
10.      <p> <a href="My pictures/diver.jpg"> <img src="My
         pictures/diver.jpg"alt="Diver" width="170" height="100"
         ></a></p>
11.          <p class="style1">Click for larger image </p>
12.      <p>Our best selling mask just got better - and cheaper<a
         href="#BMMask" >...more... </a></p>
13.      <p>E-mail for information about <a
         href="mailto:discounts@deeperblue.com.uk">diving club
         discounts</a> </p>
```

(a) State suitable entries for each of the missing values labelled A, B and C.   **3**

_____

_____

_____

14. (continued)

(b) The internal style sheet code in lines 3−6 affects the page layout. Explain the effect of the style sheet on:

   (i) Line 9   **2**

_____

_____

_____

   (ii) Line 11   **1**

_____

_____

(c) Describe **two** benefits of using an external style sheet instead of an internal style sheet, as used by Deeper Blue Sea.   **2**

_____

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(d) The website is published on the internet. However, Deeper Blue Sea realises that search engines are not finding the website. Describe how the HTML code could be modified to help a search engine find the website.   **3**

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[END OF EXEMPLAR QUESTION PAPER]

H

National Qualifications
SPECIMEN ONLY

Mark

SQ09/H/01

Computing Science

Date — Not applicable

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Town

Forename(s)

Surname

Number of seat

Date of birth

Day	Month	Year
D D	M M	Y Y

Scottish candidate number

Total marks — 90

SECTION 1 — 20 marks

Attempt ALL questions.

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×SQA

SECTION 1 — 20 marks

Attempt ALL questions

1. (a) A company is developing a new software package. State when the company would use beta testing.

1

_____

_____

(b) State **two** reasons why the client should be involved in the testing.

2

_____

_____

_____

_____

2. Clare has just started programming and has created an algorithm to search the array `cars` which holds one hundred car registration numbers.

Clare wishes to search for a specific registration number each time she uses the program. Clare's algorithm is shown below.

```
line
1     SET check TO 0
2     SET counter TO 1
3     RECEIVE registration FROM KEYBOARD
4     REPEAT
5          IF cars[counter] = registration THEN
6                SET check TO 1
7          END IF
8          SET counter TO counter + 1
9     UNTIL check = 1 OR counter = 101
```

Clare could have used a Boolean variable called "found" as part of this algorithm. She alters line 1 to read:

```
1     SET found TO false
```

2. **(continued)**

   With reference to the line numbers shown, state the other changes that Clare would need to make if she wished to use this Boolean variable.

   2

3. Jade is writing a program on her PC that is intended to run on her mobile phone.

   Explain why an emulator is required in the programming environment.

   2

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   _____

   _____

   _____

4. Scottish Airways operate a real-time booking system. To ensure the security of the data they make a daily backup of the whole system.

   Explain what additional backups would be required to ensure no loss of data in the event of a system failure.

   2

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   _____

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   _____

5. SN is a software development company. They have been invited to bid for the contract to develop software for a multinational supermarket chain.

   (a) Explain why using a rapid application development (RAD) methodology could be beneficial to SN when bidding for the contract. **2**

   _____

   _____

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   _____

   (b) Describe how Agile methodologies could be used in the effective production of the software. **2**

   _____

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6. A programming language uses 32 bits to represent real numbers such as the negative value −0·000000016.

   Explain how the 32 bits could be allocated to store such numbers. **3**

   _____

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   _____

   _____

   _____

7. A section of code has been written to total the contents of an array of 100 values.

```
line
1    SET total TO 0
2    FOR index FROM 1 TO 100
3         SET total TO total + values[index]
4    END FOR
```

(a) Explain why a compiler may be more efficient than an interpreter in the execution of this code.

2

(b) Explain the benefit of this code being present in cache memory.

2

SECTION 2 — 70 marks

Attempt ALL questions

1. A program has been written to find the **position** of the maximum value in a list, however the program stops responding. The algorithm responsible is shown below.

```
line
1     SET source TO [71,76,66,67,89,72]
2     SET position TO 1
3     FOR counter FROM 2 TO 6
4          IF source[counter]>source[position] THEN
5               SET counter TO position
6          END IF
7     END FOR
```

(a) Line 1 shows the use of a 1-D array to store the list of values, instead of six individual variables. Describe **two** advantages of using a 1-D array to store this list of values.

2

_____

_____

_____

_____

(b) A trace table is being used to record the changes to variables when stepping through the code.

(Line 4 does not change a variable's value and so is not included.)

Line	Source	Position	Counter
1	[77,66,88,67,89,72]		
2			
3			
5			

(i) Complete the information in the table above, recording the value assigned to the variable for line numbers 2, 3 and 5.

3

1. (b) (continued)

    (ii)   Explain why the loop never terminates.   **2**

_____

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_____

    (iii) Describe how the algorithm should be corrected.   **2**

_____

_____

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_____

    (iv) The program stopped responding because the loop did not terminate. This is an example of an execution error. Describe another type of error that can occur when a program runs.   **2**

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(c) Describe how a feature of the software development environment could have been used to locate the area of code with the error.   **2**

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_____

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Total marks 13

2. CheckTax have developed a function to return the taxcode (A, B, C or D) that should be used for an employee's pay. The function is to be used for employees that have income from two different sources. For example:

Combined income	Taxcode
Less than 9000	A
9000 and over (but less than 43000)	B
43000 and over (but less than 60000)	C
60000 and over	D

The inputs and output of this function are show in the diagram below.

Income1
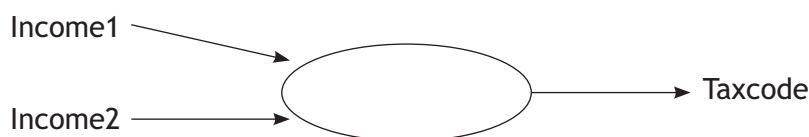
Income2

Taxcode

The function was developed using the following algorithm to determine a taxcode for any value of total income.

```
line
1     SET taxcode TO "Z"
2     SET salary TO (income1 + income2)
3     IF salary < 9000 THEN
4             SET taxcode TO "A"
5     END IF
6     IF salary > 9000 AND salary < 43000 THEN
7             SET taxcode TO "B"
8     END IF
9     IF salary > 43000 AND salary < 60000 THEN
10            SET taxcode TO "C"
11    END IF
12    IF salary > 60000 THEN
13            SET taxcode TO "D"
14    END IF
15    RETURN taxcode
```

2. (continued)

(a) Explain why this algorithm would return an incorrect taxcode if income1 is 30000 and income2 is 30000.

2

_____

_____

_____

_____

(b) The lead programmer comments that the use of a series of IF statements is inefficient.

Using pseudocode or a language with which you are familiar, rewrite the algorithm to correct the logic error and make the code more efficient.
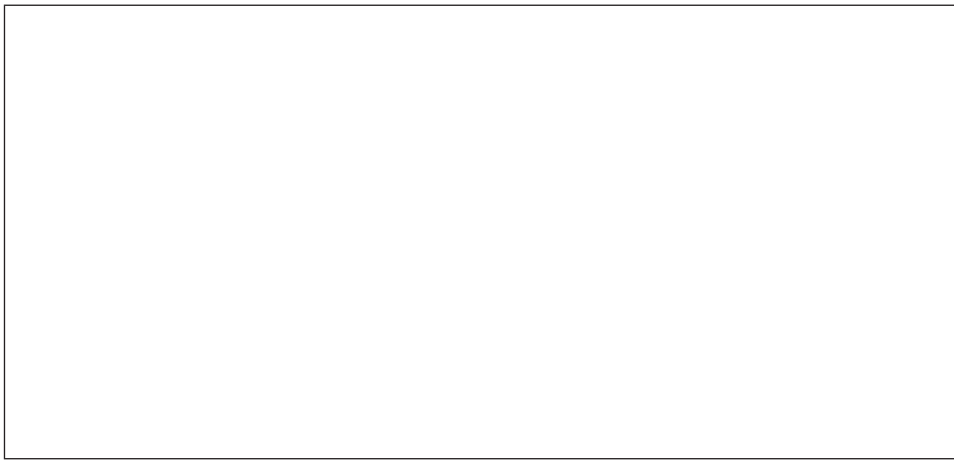
3

2. (continued)

(c) Jeanette works for a bank and has downloaded the corrected function, `taxcode`, from CheckTax's online library. Bank employees receive an annual salary and bonus pay and Jeanette's program stores these values in variables `salary` and `bonus`. It also stores the employee's tax code in a variable called `code`.

Using pseudocode or a language with which you are familiar, write an algorithm for a subroutine that will:

- Ask the user for the values for variables `salary` and `bonus`
- Use the function to assign the variable `code`
- Display `code` on screen

3

(d) Jeanette has commissioned CheckTax to create some software for the bank. Part of the software will be designed for a web-based system. CheckTax have decided to use wire-framing as part of the design process.

Describe **two** factors that CheckTax will have to consider while using wire-framing.

2

3. The weather statistics are recorded for each day of the 30 days of November. For each day, the statistics recorded include the rainfall in millimetres and the lowest temperature. Some of the data is shown below.

Day		Rainfall		Lowest temperature
1		12		8
2		5		4
3		0		-3
4		5		1
5		0		-4
. . .		. . .		. . .
30		21		6

(a) The rainfall figures are held in an array called `rainfall` and the lowest temperatures in an array called `lowtemp`. Using pseudocode or a language with which you are familiar, write an algorithm to count the number of dry days below freezing and write this number of days to a text file called `drydays`. **5**
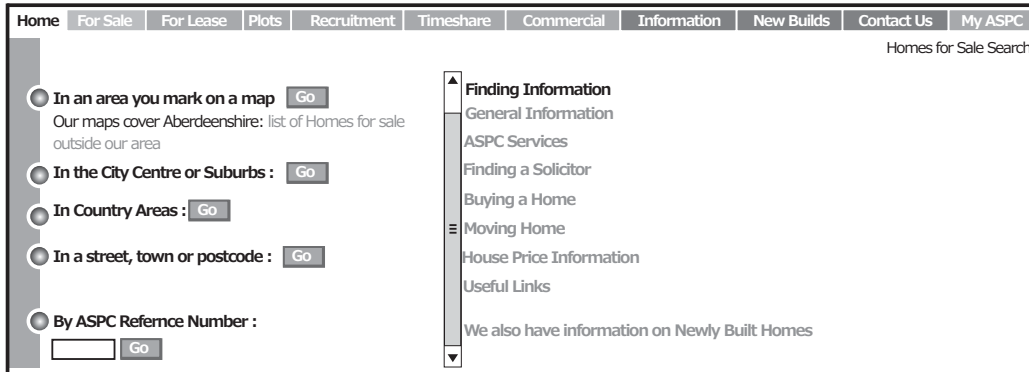
3. (continued)

(b) The algorithm used to count the number of dry days below freezing is implemented as a subroutine. Describe how the subroutine could make this value available to other parts of the program.

1

_____

_____

_____

_____

4. Homeview is an estate agent which specialises in the sale of residential properties in Aberdeenshire. It uses a dynamic database-driven website to display the range of properties it has for sale. Details of each property are held within a relational database.

| Home | For Sale | For Lease | Plots | Recruitment | Timeshare | Commercial | Information | New Builds | Contact Us | My ASPC |

Homes for Sale Search

○ **In an area you mark on a map** [Go]
Our maps cover Aberdeenshire: list of Homes for sale outside our area
○ **In the City Centre or Suburbs :** [Go]
○ **In Country Areas :** [Go]
○ **In a street, town or postcode :** [Go]

○ **By ASPC Refernce Number :**
[ ] [Go]

Finding Information
General Information
ASPC Services
Finding a Solicitor
Buying a Home
Moving Home
House Price Information
Useful Links

We also have information on Newly Built Homes

(a) Describe **two** reasons why a dynamic database-driven website is a benefit for site visitors. **2**

_____

_____

_____

_____

(b) The managing director of Homeview wants to update the website and change the appearance of the text throughout all the web pages. He instructs his technical staff to make the following changes using cascading style sheets (CSS).

Text	Font	Size	Colour	Style
Headings	Verdana	20	Black	Bold
Sub Headings	Tahoma	16	Red	Bold
Body Text	Arial	12	Blue	Regular

Create a CSS rule that will implement the changes for the Sub Headings. **3**

4. **(continued)**

(c) To gain access to more detailed property information, users must complete a registration form to create a unique username and password.

Describe **one** example of input validation that could be applied to a **username** when it is first registered. **1**

_____

_____

_____

(d) When registering, the user must enter a valid e-mail address. This validation process is carried out by code written in a scripting language.

In the language used, the syntax for an IF statement is:

```
if (expression)
{
    command(s)
}
```

and the OR comparator is written using the symbol ||

The following code is used to validate the e-mail address:

```
if (atpos<2 || dotpos<atpos+2 || dotpos+2>=length)
{
    alert("Not a valid e-mail address");
    return false;
}
```

In the code above:

- the variable `length` stores the number of characters in the e-mail address
- the variable `atpos` stores the position of the @ character
- the variable `dotpos` stores the position of the last dot

For example, if the e-mail address is myname@sqa.com
then `length` = 14, `atpos` = 7 and `dotpos` = 11

Explain how the code above would process the validation of the e-mail address: my.name@net **3**

5. Choose a contemporary development in intelligent systems.

(a) Briefly describe the main features of this development. **2**

_____

_____

_____

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_____

(b) Describe **one** beneficial economic impact of this development. **1**

_____

_____

_____

(c) Describe **one** problem that this development might cause for society. **1**

_____

_____

_____

6. Dog Walkers is a company that walks dogs when their owners are at work.

The company has a database to store details of the dogs, their owners and the walkers. The data is stored in the following tables.

Dog	Owner	Walk	Walker
Dog ID	Owner ID	Walk ID	Walker ID
Dog name	Owner name	Dog ID*	Walker name
Dog type	Owner address	Walker ID*	Walker phone number
Gender	Owner phone	No. of days per week	
Walks well with others		Cost	
Photo			
Owner ID*			

(a) State **two** one-to-many relationships that exist between the tables.

2

_____

_____

_____

_____

6. **(continued)**

The following form is used to enter each dog's details.

Dog walkers

Dog name	Buster
Dog type	Golden Labrador
Gender	Male
Walks well with others	Yes
Photo	
Owner ID*	123

(b) Describe **two** ways of improving the usability of this form.   **2**

_____

_____

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6. **(continued)**

(c) The following is produced for a walker.

Walker: Susan			
Dog name	**Dog type**	**Owner address**	**Walks well with others**
Bertie	Basset Hound	6 Flower Way	Yes
Buster	Golden Labrador	103 Mayflower	Yes
Goldie	Spaniel	65 Varley Road	Yes
Ralph	German Shepherd	The Drive	Yes

Describe how the company would use the database software to produce this report.

5

**7.** WebGo develop websites for mobile devices. WebGo have developed a site for a new university.

(a) The university would like the website to incorporate an internal search engine. Search engines make use of crawler software.

Describe **two** ways that WebGo could ensure that the new website was optimised for indexing by crawler software.

2

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(b) Students have reported issues with one of the web pages that is returned following a search.

The web page is supposed to display images of the student union gym and cafeteria. When the page loads the images appear as follows.

⊠ img24535
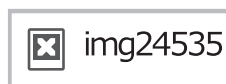
Explain how the HTML code could be changed to make this web page more accessible in the event of images not appearing on screen.

2

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7. (continued)

(c) The university has a web page devoted to foreign exchange students. As part of this web page there is an image of a national flag. The image can be compressed using a lossless compression technique.

Explain why lossless compression results in a significant reduction in the file size for this image.

2

8. Vol4Ecosse is a non-profit organisation based in Scotland. The group send students to work on community-based projects throughout the country.

Students can access the Vol4Ecosse website and complete some user forms to update their current location and the status of each project.

(a) Vol4Ecosse decide to make use of server-side validation when handling forms that keep track of progress.

Describe **two** reasons why server-side validation may be more appropriate than client-side validation in this case.

2

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(b) Whilst volunteering, the students are encouraged to update the status of different projects throughout the country by adding text and photographs to a shared web-based folder. Explain why cloud storage might be best suited for this purpose.

2

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_____

(c) The Regulation of Investigatory Powers Act 2000 (RIPA) has implications for Vol4Ecosse and their Internet Service Provider (ISP).

(i) Describe the financial implications of this Act for ISPs.

1

_____

_____

(ii) Describe **one** reason why RIPA is becoming increasingly difficult to enforce.

2

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9. WebScape is a web design company. It is developing a website that will be accessible on many devices including tablets, laptops and smartphones. The site is hosted on their web server.

(a) Describe how accessible design can be achieved using cascading style sheets (CSS).

2

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(b) A typical page in the website is tested and requires optimisation.

```
<body>
<script  src="http://webscape.org.uk/js/jquery.js"></script>
<script  src="http://webscape.org.uk/js/jquery.once.js"></script>
<script  src="http://webscape.org.uk/js/drupal.js"></script>
<script  <src="http://webscape.org.uk/js/panels.js"></script>
<style>
.center_div
{
border:1px solid gray;
margin-left:auto;
margin-right:auto;
width:90%;
background-color:#d0f0f6;
text-align:left;
padding:8px;
}
</style>
<img  src="boat1.gif" alt="Big Boat">
<img  src="logo.gif" alt="logo">
<img  src="boat2.gif" alt="Big Boat2">
<img  src="welcome.gif" alt="Welcome Message">
</body>
```

9. **(b)** **(continued)**

(i) Explain how the code above could be altered to optimise load times.

2

_____

_____

_____

_____

(ii) Describe **two** ways that compression can be used to reduce the time to retrieve and display a web page.

2

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[END OF SPECIMEN QUESTION PAPER]

H

National
Qualifications
2015

Mark

X716/76/01

Computing Science

WEDNESDAY, 6 MAY
9:00 AM – 11:00 AM

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 working.

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
©

X716760101

HTP

SECTION 1 — 20 marks

Attempt ALL questions

1. Convert the decimal number −120 to binary using 8 bits.   1

2. Tables can be related by different types of relationships. State the type of relationship between the two tables in each case below.

   (a) People and Hobbies   1

   _____

   (b) Jockeys and Horses in a horse race   1

   _____

3. An online company uses a computer program to display particular customer records. The algorithm of this program is shown below.

```
Line 1      SET found TO false
Line 2      RECEIVE search_name FROM (STRING) KEYBOARD
Line 3      FOR counter FROM 0 TO <End Of List> DO
Line 4          IF name[counter] = search_name THEN
Line 5              SET found TO true
Line 6              SEND name[counter] & counter TO DISPLAY
Line 7          END IF
Line 8      END FOR
Line 9      IF found = false THEN
Line 10         SEND "Name not found" TO DISPLAY
Line 11     END IF
```

The following data is stored in the name array:

Jimmy, Samina, Kate, Jimmy, Adam

State the output from the above program if Jimmy is entered at line 2 from the keyboard.

2

4. One feature of a declarative language is the use of facts. Three facts are shown in lines one to three below:

```
Line 1    human(einstein).
Line 2    human(pascal).
Line 3    human(lovelace).

Line 4    mortal(X):-human(X).
```

State the feature being used in line 4 and explain a benefit of its use.

2

5. A business is setting up a new communications network. Describe two implications of the Regulation of Investigatory Powers Act (2000) for this business.

2

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6. Innes regularly uses a shopping website called Better Shop.

Scripting is used to generate parts of the website.

(a) State **one** part of the website that is generated using client-side scripting.

1

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_____

(b) State **one** part of the website that is generated using server-side scripting.

1

_____

_____

7. Craig has been asked to write an algorithm that will search for a target ID from a list of fifty receipts. Each receipt has a unique receipt ID. Part of the algorithm is shown below.

Line 1	SET found TO false
Line 2	SET counter TO −1
Line 3	RECEIVE target_id FROM (INTEGER) BARCODEREADER
Line 4	REPEAT
Line 5	SET counter TO counter + 1
Line 6	IF receipt_id [counter] = target_id THEN
Line 7	SET found TO true
Line 8	END IF
Line 9	UNTIL _____

Using pseudocode, or a language with which you are familiar, complete line 9 of the algorithm shown above.

2

8. Describe **two** benefits of prototyping when following a rapid application development methodology.

2

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_____

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_____

9. Explain how cache memory can improve system performance.

2

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[Turn over

10. Describe how usability testing could be carried out on a website.

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11. A database table may have a compound key. State what is meant by the term compound key.

_____

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SECTION 2 — 70 marks

Attempt ALL questions

12. A hardware company uses a relational database with the four tables shown below.

Customer	Item	Order	Sale
Customer ID	*Item ID*	*Order no*	*Order no **
Customer name	*Description*	*Customer ID **	*Item ID **
Customer address	*Cost*	*Date*	*Quantity*
Customer email	*Image*		

(a) Identify a suitable primary key for the **Sale** table.　　　1

(b) Draw an *entity-relationship diagram* to illustrate the relationships between the four tables.　　　3

12. (continued)

(c) A report is produced each time a customer makes an order. An example is shown below.

Customer	Mr D Gryffe	Order no	10728
	12 Gourock Crescent	Date	23/4/15
Item	Number ordered		Cost
Grease spray	1		£6·99
Bell wire (100 m)	1		£8·50
Towel radiator	1		£121·50
Disposable mouse trap	2		£9·98
		Total	£146·97

This report is based on a query. State a list of the tables and fields that would be used in this query and any criteria that would be used to select the above data.　　　3

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_____

(d) The report includes a single total of £146·97 after the four subtotals. Describe how this can be done in the report.　　　3

_____

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_____

13. EcoCaledonia are an energy company based in Scotland. Sales representatives visit people's houses in an attempt to gain business from new customers.

The sales representatives take a tablet device and often show video clips using apps and mobile websites.
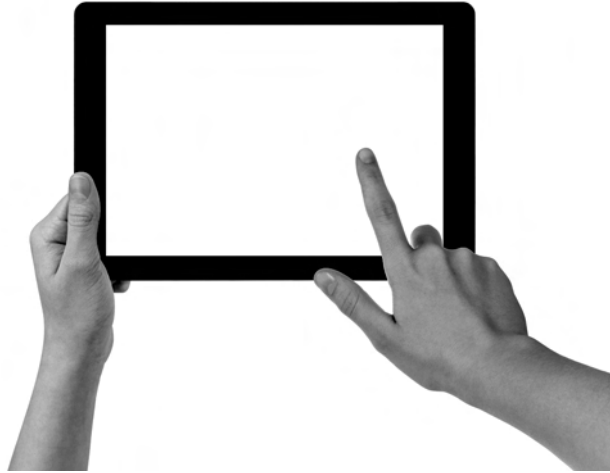
(a) Describe how quad-core processors can be used to improve load times for web apps containing client-side scripts or multimedia.   2

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(b) Describe how compression reduces the file size of videos.   3

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13. (continued)

(c) EcoCaledonia plan to launch an app that will allow customers with Internet access to turn their heating system on using a mobile device.

Describe how EcoCaledonia could ensure that all customers could use the software regardless of the operating system on their device.

2

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(d) Customers of EcoCaledonia can sign in to their account to supply meter readings, pay bills and update contact details.

Explain how their details are secure when transmitted.

3

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[Turn over

13. (continued)

(e) When signing in to their account customers have to enter details from their username and password as shown below.

Your username
Enter the following characters from your username

Enter the 3rd character ◻

Enter the 4th character ◻

Enter the 1st character ◻

Your password
Enter the following characters from your password

Enter the 3rd character ◻

Enter the 4th character ◻

Enter the 1st character ◻

⬅ ➡

Explain why customers are asked to enter their details in a random order each time.

1

14. EcoCaledonia recruits employees using an online application form. Rowena completes her form and receives the feedback below:

Please correct the following information

* Indicates required fields

Title: * Miss ▾

First name: * Rowena

Surname: * Drayton

Gender: * ○ Male ● Female

Email address: * rowenadrayton@schoolmail.co.uk

Mobile phone number: 077g6367324

Please enter a valid mobile phone number

Are you happy to receive information from our partner companies ☑

(a) State the most appropriate data type used to store the value of the "receive information" check box.

1

_____

(b) Rowena accidentally entered an invalid mobile phone number and an error message is displayed. A valid mobile phone number will consist of a string of 11 digits.

Using pseudocode or a programming language of your choice, write the algorithm which would check that the mobile phone number is valid.

5

14. **(continued)**

(c) An algorithm is implemented to validate the applicant's data from the application form opposite. There are two subprograms at lines two and three. The parameters for these subprograms are not shown.

Line 1	REPEAT
Line 2	Enter_applicant_data (…)
Line 3	Validate_form_data (…)
Line 4	UNTIL <form data is valid>

Name a parameter that should be passed at line 2, state the type of parameter passing used and justify your answer.   2

_____

_____

_____

_____

(d) EcoCaledonia has its own servers which need to be upgraded and is considering migrating to a hybrid cloud.

  (i) Describe what is meant by a hybrid cloud.   1

_____

_____

  (ii) State **two** advantages for EcoCaledonia of switching to a hybrid cloud.   2

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[Turn over

15. A local hair salon has a desktop computer, a tablet computer and a printer. These devices are networked using a wireless connection.

(a) The hair salon needs to use software that is only available for an older operating system. State how the hair salon could run this software on their system. **1**

_____

_____

(b) Staff can access all files on the network. Customers can only access a catalogue file of various hair styles. Describe how the operating system allows these restrictions to be set up. **2**

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(c) A digital camera is used to take the customer's photograph and then the camera is connected to the desktop computer using an interface.

(i) State **two** tasks undertaken by an interface when transferring these photographs to the desktop computer. **2**

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(ii) The photograph can then be edited so that the customer can view it with a range of hair styles and colours. This photograph could be a bitmap or vector graphic. Select one type of graphic and explain why it is suitable for this purpose. **2**

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15. **(continued)**

(d) The hair salon also has some video clips stored on their computer that they use to train staff.

Calculate the uncompressed file size of one of these video clips which is 90 seconds long and was captured at 25 frames per second with a resolution of 260 by 200 pixels and 16 777 216 colours.

State your answer in appropriate units and show all working. **2**

(e) The manager of the hair salon is considering whether to buy new computers or to upgrade the existing ones.

(i) Describe **one** environmental advantage of upgrading. **1**

_____

_____

(ii) Describe **one** environmental advantage of buying new computers. **1**

_____

_____

[Turn over

16. Joseph has been asked to develop a website for the Glasburgh Safari Park where visitors can go to see animals including pandas. Joseph often makes use of cascading style sheets which can be internal or external.

(a) Describe the difference between an internal style sheet and an external style sheet.

2

_____

_____

_____

_____

(b) Explain why the use of external style sheets may result in optimal load times when compared to the use of internal style sheets.

2

_____

_____

_____

_____

(c) Joseph is using an external style sheet named "masterstyle". Complete the HTML code that will successfully link to this stylesheet.

2

<link rel = _____ type= "text/css" href= _____>

(d) Joseph includes a rule in the external style sheet to make all the large headings appear in Tahoma font, blue and centred wherever they appear on each page.

Write a CSS rule to manage these large headings.

3

16. **(continued)**

(e) Searching for the 'Glasburgh Safari' or 'pandas' on the World Wide Web with a search engine does not give a prominent result for this site. Describe **two** ways that Joseph can improve this without incurring any further costs.

2

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_____

(f) Customers can purchase tickets via the website.

Explain how the use of a database driven website would allow the safari park to display a message if there were only a small number of tickets left on a certain day.

2

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_____

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[Turn over

17. Chris wants a program to process information about each of the pupils in his class.

Line 1	RECORD Test_marks IS {STRING surname, INTEGER mark_1, INTEGER mark_2, INTEGER mark_3, STRING email}
Line 2	SET pupil[1] TO ("Smith", 67, 89, 91, "john@doodle.co.uk")
Line 3	SET pupil[2] TO ("Latif", 42, 91, 84, "fatima@doodle.co.uk")
Line 4	SEND pupil[1].mark_2 TO DISPLAY

(a) (i) Explain the purpose of line 2. **2**

_____

_____

_____

_____

   (ii) State the output from line 4. **1**

_____

_____

   (iii) Chris wants to calculate the average for the first pupil. Using pseudocode, or a language with which you are familiar, write the line to calculate this average. **2**

17. **(continued)**

(b) Chris calculates the average mark for each pupil and stores the average marks in an array. He writes the following pseudocode to count the number of grade A passes of 70 or more:

```
Line 1      SET list TO [74.33, 57.67, 73.33, 82.33]
Line 2      SET amount TO 0
Line 3      FOR counter FROM 0 TO 2 DO
Line 4            IF list[counter] >= 70 THEN
Line 5                  SET amount TO amount + 1
Line 6            END IF
Line 7      END FOR
Line 8      SEND amount TO DISPLAY
```

When Chris tests the program, it outputs the wrong number of A passes.

   (i)   State the output from the code above.   1

   _____

   (ii) State the name of this type of error.   1

   _____

   (iii) Identify and correct the line of the algorithm which contains the error.   2

[Turn over for Question 17(c) on *Page twenty-two*

17. (continued)

(c) Chris creates an algorithm that will search the array of average marks and return the smallest value present.

```
Line 1 SET list to [74.33, 57.67, 73.33, 87.33]
Line 2 SET minimum TO list [0]
Line 3 FOR counter FROM 1 TO 3 DO
Line 4     IF minimum > list[counter] THEN
Line 5         SET minimum TO list[counter]
Line 6     END IF
Line 7 END FOR
```

A trace table is used to record the change to a variable at the corresponding line number. Part of the trace table is shown below. State the values missing from the trace table below at A, B and C.

Line	list	minimum	counter
1	74.33, 57.67, 73.33, 87.33		
2		A	
3			B
5		C	
3	………	…………	………

3

A _____

B _____

C _____

(d) Explain how breakpoints could be used in conjunction with a trace table to locate errors in code.

2

_____

_____

_____

_____

[END OF QUESTION PAPER]