H

National Qualifications
SPECIMEN ONLY

Mark

SQ09/H/01

Computing Science

Date — Not applicable

Duration — 2 hours

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
D D	M M	Y Y

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 booket. 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

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**

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   _____

   (b) State **two** reasons why the client should be involved in the testing. **2**

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   _____

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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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

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

2

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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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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 →
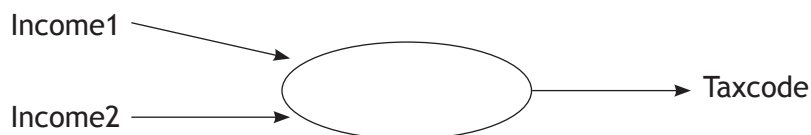
Income2 → ( ) → Taxcode

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**

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(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`.
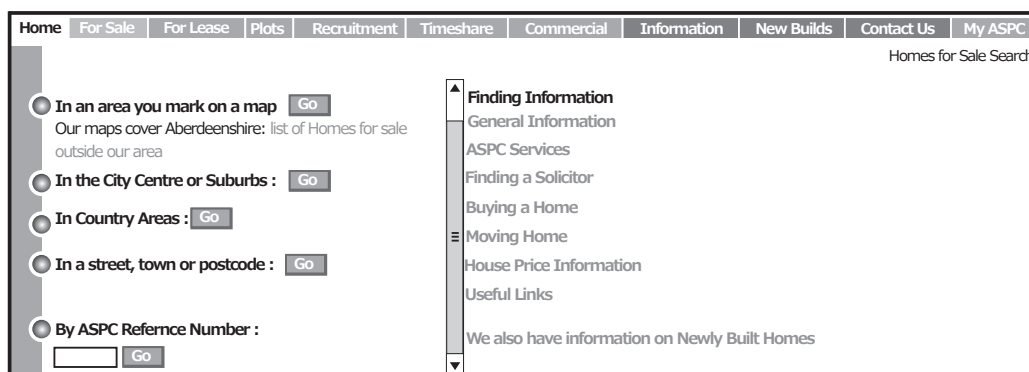
5

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

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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**

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

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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**

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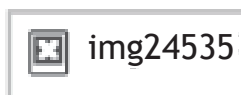
Explain how the HTML code could be changed to make this web page more accessible in the event of images not appearing on screen.

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

(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

(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

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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      _____

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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

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(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]

ADDITIONAL SPACE FOR ANSWERS

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