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Mark

EP09/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

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.



SECTION 1 — 20 marks

Attempt ALL questions

MARKS

DO NOT
WRITE IN
THIS
MARGIN

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

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

2

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

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

2



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

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

- (b) Explain how this problem could be solved.

2



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

2

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



* E P 0 9 H 0 1 0 4 *

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	andyandy	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



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.

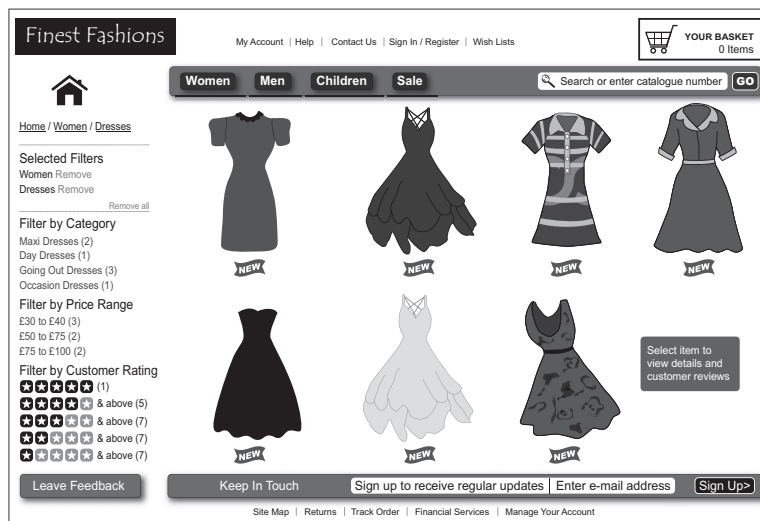
Describe two examples of other types of test data that should be used in this test plan.

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)

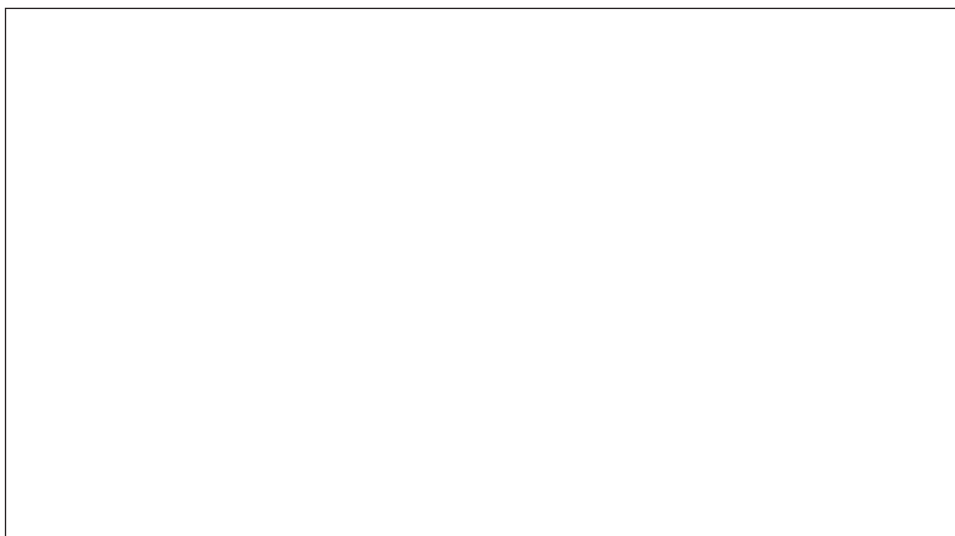
- (b) The website allows customers to leave ratings of 1 to 5 stars for any items purchased. As each rating is received, a server-side script is used to recalculate the average rating for the item and then update the average rating displayed on the website.

 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:

Security Warning

 finestfashions.co.uk

Data you input to this site cannot be seen or changed by anyone else. However, there is an issue with the website's security certificate.

-  The security certificate is from a trusted source.
-  The security certificate date is correct.
-  The website url on the security certificate is not valid or does not match the website's name.

Do you wish to proceed?



* E P 0 9 H 0 1 0 9 *

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



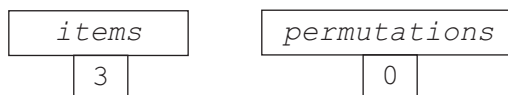
11. A function used to perform an arithmetical operation is shown below:

```
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:



(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



11. (b) (continued)

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

3

(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



* E P O 9 H 0 1 1 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
<u>Driver number</u>	<u>Driver number*</u>	<u>Registration number</u>	<u>Route number</u>
Driver name	<u>Registration number*</u>	Capacity	Origin
Mobile number	<u>Date</u>	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

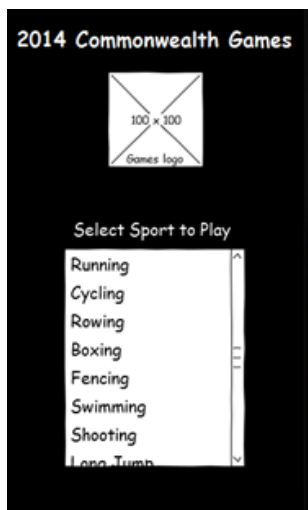
4

- (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.

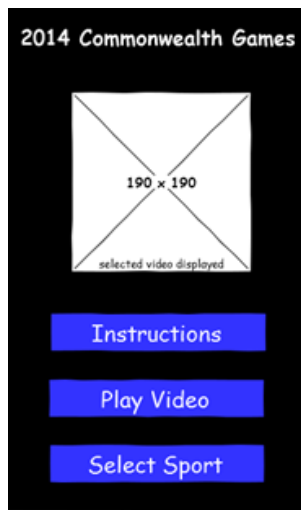
2



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

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

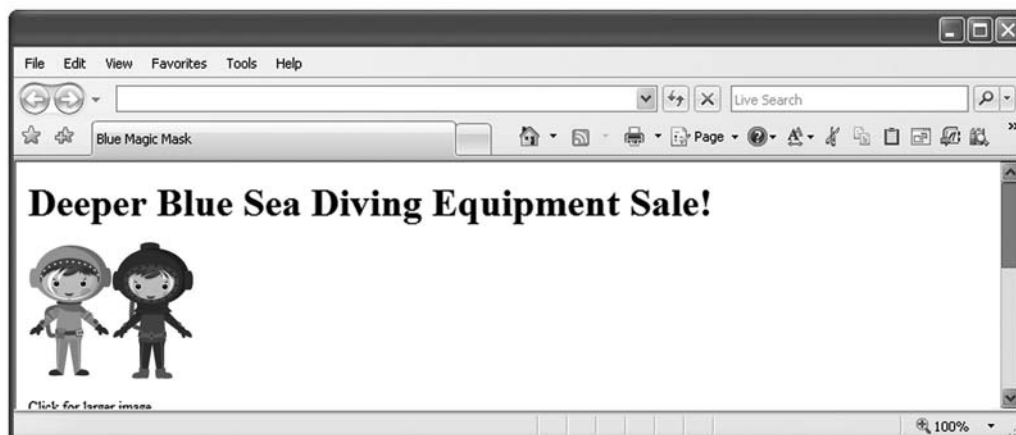
(iv) Many owners of a smartphone sign up to the online forum run by the manufacturer of the device.

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"> </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

(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

[END OF EXEMPLAR QUESTION PAPER]

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