

FOR OFFICIAL USE



National Qualifications					Mark

CS(N5)14A

Computing Science

Duration – 1 hour and 30 mins

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forenames(s)

Surname

Number of seat

Date of birth

Day

Month

Year

D	D
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M	M
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Y	Y
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Scottish candidate number

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Total marks - 90

SECTION 1 - 20 marks

Attempt ALL questions in this section.

SECTION 2 - 70 marks

Attempt ALL questions in this section.

Read all questions carefully before attempting.

Write your answers in the spaces provided, using blue or black ink.

Show all workings.

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

Attempt ALL questions

1. Convert the value 37 into an 8-bit *binary* number. Show your working.

1

2. Name the *bus* used to select memory locations to be read from or written to by the processor.

1

3. The *pseudocode* below shows how a program could store and process the top scores of the players in an online computer game.

```
Line 1. SET topscores TO [1209, 1302, 1532, 1092, 1892,  
1365, 2341, 2321, 1539, 1155]  
Line 2. SET high_score TO topscores [0]  
Line 3. FOREACH score FROM topscores DO  
Line 4.     IF score > high_score THEN  
Line 5.         SET high_score TO score  
Line 6.     END IF  
Line 7. END FOREACH  
Line 8. SEND ["The top score is: ", high_score] TO DISPLAY
```

State the most suitable *data structure* and data type for storing the highlighted variable (**topscores**) used above.

2

4. A *web page* can be found using the URL:

<http://www.ednet.com/groups/national-5-computing-science/home.php>

State the *protocol* being used by this URL.

1

5. The following section of code is written in the programming language Ada.

```
while not Text_IO.End_Of_File loop
while not Text_IO.End_Of_Line loop
Text_IO.Get (Item=>Char);
if Char in Printable then
Counts (Char) := Counts (Char) + 1;
end if;
end loop;
Text_IO.Skip_Line;
end loop;
for I in Counts
if Counts(I) > 0 then
Text_IO.Put (I & ": ");
for J in 1 .. Counts(I) loop
Text_IO.Put ('*');
end loop;
Text_IO.New_Line;
end if;
end loop;
```

State **two** techniques that the programmer could use to make this code more readable.

2

6. Explain why the data values TRUE and FALSE should be stored in a field of type *Boolean* rather than a field of type *text*.

1

7. Companies must adhere to health and safety legislation for employees using computer systems regularly.

Adjustable blinds or curtains can reduce the amount of screen glare and reflections for users to prevent eyestrain.

Name **one** other workstation feature and describe how it reduces a risk to health.

1

8. State where instructions and data are held within the processor after being transferred from memory.

1

9. Describe the role of the *client* in a *client/server* network.

1

Abergow Hospital has recently upgraded all the computer systems used by staff. They have arranged for the environmentally friendly disposal of the old equipment.

10. Describe **one** other issue that should be considered when disposing of the old equipment.

1



MARKS

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11. Describe **one** typical feature of an operating system developed to support smartphones of the type shown.

1

12. Face recognition is one example of *biometrics* that can be used to secure access to mobile devices.

Describe **one** benefit of face recognition for this purpose.

1

13. A web site has been hacked and the usernames, email addresses and passwords of users have been stolen.

(a) Describe how *keylogging* software may have been used in this hacking attack.

1

(b) Explain what users should do to protect their security after this hacking attack.

1

14. Explain why *JavaScript* is required to validate data in a HTML form **before** it is submitted.

2

15. Here is part of a database used to store information about meteor showers.

Name	Rate	Ascension	Dec	From comet	Observations
Quadrantids	100	15h 28m	50°	Unknown	Average speeds
Ursids	5	14h 28m	76°	Tuttle	Average speeds
Geminids	1	7h 32m	32°	Unknown	Average speeds
Kappa Cygnids	10	19h 29m	55°	Unknown	Bright, exploding fireballs
Kappa Cygnids	10	19h 20m	55°	Unknown	Bright, exploding fireballs
S.lota Aquarids	15	22h 32m	-15°	Unknown	Double radiant
N.lota Aquarids	13	22h 04m	-6°	Unknown	Double radiant
Beta Taurids	10	5h 41m	19°	Encke	Double radiant
S.Delta Aquarids	36	22h 36m	-17°	Unknown	Slow, double radiant
N.Delta Aquarids	30	22h 36m	0°	Unknown	Slow, double radiant
Capricornids	15	21h 0m	-15°	Unknown	Slow, double radiant
Ophiuchids	12	17h 20m	-20°	Unknown	Slow, double radiant
Perseids	70	3h 04m	58°	Unknown	Very fast
Phoenicids	25	01h 00m	-55°	Unknown	Very fast
Leonids	23	10h 08m	22°	Tempel-Tuttle	Very fast
Eta Aquarids	18	22h 25m	0°	Halley	Very fast
Beta Perseids	12	3h 12m	43°	Swift-Tuttle	Very fast

Describe how the data has been sorted.

2





SECTION 2 - 70 marks

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Attempt ALL questions

16. Social media allows users to share web links with others.

Shares for http://www.glew.org.uk	
Social Network	Number of Shares
	236
	231
	190
	410

To calculate the popularity of a web link, the number of times it has been shared on different social media platforms are added together.

In the table shown, the popularity is 1067 (236 + 231 + 190 + 410)

A program is designed to calculate the popularity of a web link from a list of shares on social media sites.

```

Line 1.    SET popularity TO 0
Line 2.    RECEIVE weblink FROM keyboard
Line 3.    SET weblink TO lowercase(weblink)
Line 4.    REPEAT
Line 5.        RECEIVE shares FROM keyboard
Line 6.        SET popularity TO popularity + shares
Line 7.    UNTIL shares = -1
Line 8.    SEND ["The popularity of web link ", weblink, "
                is ", popularity, "."] To DISPLAY
    
```

(a) (i) The above design was created using *pseudocode*. Name another *design notation* that could have been used instead.

1

(ii) Describe **one** advantage of using this *design notation* rather than *pseudocode*.

1



Question 16 (continued)

MARKS

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Identify the *variables* and state their *data types* used in the program
(b) design.

3

	Variable	Data type
1.		
2.		
3.		

A pre-defined function is used on Line 3 of the design. State the name of another predefined function which you are familiar with and describe its
(c) purpose.

2

(d) Line 1. SET popularity TO 0
 Line 2. REPEAT
 Line 3. RECEIVE shares FROM keyboard
 Line 4. SET popularity TO popularity + shares
 Line 5. UNTIL shares = -1

The program above stops when the user enters -1.

There is an error in this program which means that -1 is always added to the “popularity” before the program finishes.

Use pseudocode or a programming language of your choice to show how you would correct the program so that this error is removed.

3

Total Marks 10



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```
swap(pos1, pos2, mystring)
echo(mystring)
```

Swap the character at position pos1 with the character at position pos2 in a string of text mystring.

Write the string mystring to the display.

These can be used by the programmer to manipulate strings of text.

An example program, with notes on the execution, are shown below. The first character in a string is always position 1.

```
SET mystring TO "Passphrase"
SET val TO 1
WHILE val < 3
    SET mystring TO swap(val, val+3, mystring)
    SET val TO val + 1
END WHILE
echo(mystring)
```

```
mystring = Passphrase
val is 1
In the loop the following two
passes occur:
    val=1,
    mystring = "sasPphrase"
    val=2,
    mystring = "spsPahrase"
```

Output is "spsPahrase"

(a) State the output that would be created by the following program.

3

```
SET newstring TO "computing"
SET counter TO 3
WHILE counter > 0
    SET newstring TO swap(counter, counter + 2, newstring)
    SET counter TO counter - 1
END WHILE
echo(newstring)
```

Show your working.

C

(b) State the type of loop shown in the program. Justify your answer.

MARKS**2**

The program is used to generate 800 strings each with a length of 128
(c) characters. These are stored in a text file using an 8-bit character set.

Calculate the *storage requirements* of this saved text file. Give your answer in appropriate units.

Show your working

3

A change is made to the program but when it is translated the following
(d) error message is displayed.

```
Error: Unexpected use of ";" at line 12
```

Name the type of error that has occurred. Justify your answer.

2**Total Marks 10**



18. The following HTML is used to create a web page.

```
<!DOCTYPE html>
<html>
  <head>
    <title>GameZone - Hi-Scores</title>
  </head>
  <body>
    <h1>Select Title</h1>
    <a href="player/hiscore-halo.html">Halo Arena</a>
    <a href="http://halo-arena.com/index.htm">Game Site</a>
    <a href="player/hiscore-gw.html">Guild Wars</a>
    <a href="http://guildwars2.com/home.htm">Game Site</a>
  </body>
</html>
```

MARKS

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From the HTML above, identify an *internal hyperlink* and an *external (a) hyperlink*.

2

Internal hyperlink

External hyperlink

This web page is stored in the root directory of the server

“http://www.gamezone.com”.

Use this information to change one of the *relative* addresses used in the (b) web page to an *absolute address*.

1

C



Draw a diagram to illustrate the navigation structure used in the web page
(c)above.

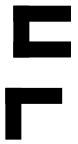
MARKS

1

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Describe a test that should have taken place when this web page was being
(d)developed.

1



MARKS

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(e) The follow web page code has been created to ensure *accessibility*.

```
<a href="#maincontent">Skip navigation</a>

<a href="home.html">Home</a>
<a href="games.html">Games</a>
<a href="players.html">Players</a>
You are at
<a href="home.html">Home:</a>
<a href="games.html">Games:</a>
<a href="haloarena.html">Halo Arena</a>
<h1 id="maincontent">Halo Arena</h1>
```

(i) Give **two** examples, from the code above, which increase the accessibility of the web page.

2

(ii) For **each** example given in (i) above, explain why it makes the page more accessible.

2



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- (f) The web site provides an option for users to save pages as PDF files.
Describe why PDF files may be used for this purpose.

1

Total Marks 10

19. Robotic vacuum cleaners are increasingly found in modern homes. These robots move around the room and use sensors to detect when they make contact with obstacles.

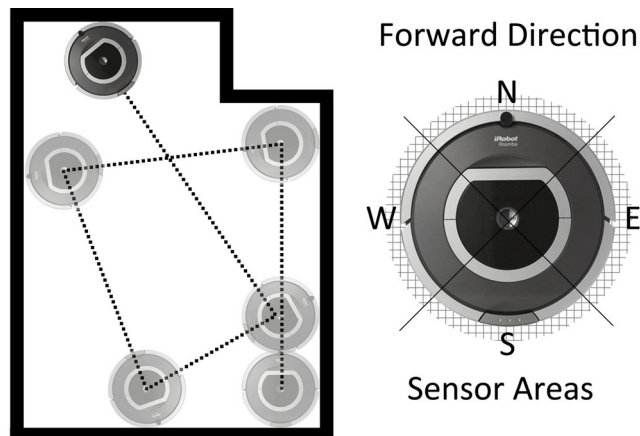
- (a) A typical robot requires sensors to measure the dimensions of the room as the robot moves. It will also use other sensors to detect when it makes contact with an obstacle.

State the hardware that allows external hardware, such as the sensors, to be connected to the computer system in the robot.

1

Question 19 (continued)

MARKS
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The *pseudocode* below shows a design for part of the program used by the robot. There are **two** errors in the logic of the program design. Find and describe each error made.

2

```

Line 1.      REPEAT
Line 2.          SEND move forward TO motor
Line 3.          RECEIVE touch FROM (string) SENSOR
Line 4.          IF touch = "N" AND touch = "E" THEN
Line 5.              SEND turn left TO motor
Line 6.              IF touch = "W" THEN
Line 7.                  SEND turn right TO motor
Line 8.              ELSE
Line 9.                  SEND stop TO motor
Line 10.             WAIT 10 Seconds
Line 11.             SEND move forward TO motor
Line 12.          ENDIF
Line 13.      ENDIF
Line 14.  UNTIL end of cleaning session
    
```

Error	Line number	Description
-------	-------------	-------------

1.

2.

MARKS

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(c) To operate the robot two settings are entered. The length of operation, in minutes from (1 to 60) and the power setting (where 1 is economy mode, 2 regular mode and 3 is super clean).

(i) Complete the table below to show the four examples of *test data* and the type of each example.

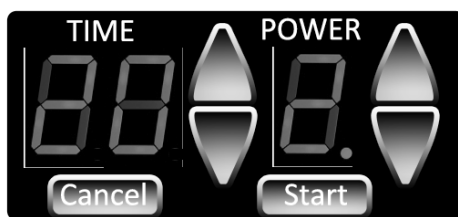
3

Test data	Type of test data
operation - 27 minutes, power - 2	normal
operation - 60 minutes, power - 1	
operation - 65 minutes, power - 4	extreme

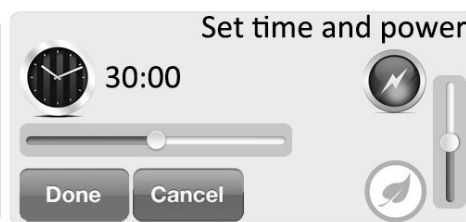
(ii) Explain the purpose of fully testing a program using a variety of test data.

1

(d) There are two versions of the robot cleaner. The user interfaces for version 1.0 and version 2.0 are shown below. Version 1.0 has buttons that are pressed to change the values and control the robot. Version 2.0 has a touch screen.



Version 1.0



Version 2.0

(i) Describe two advantages of the user interface for version 2.0 when compared to version 1.0.

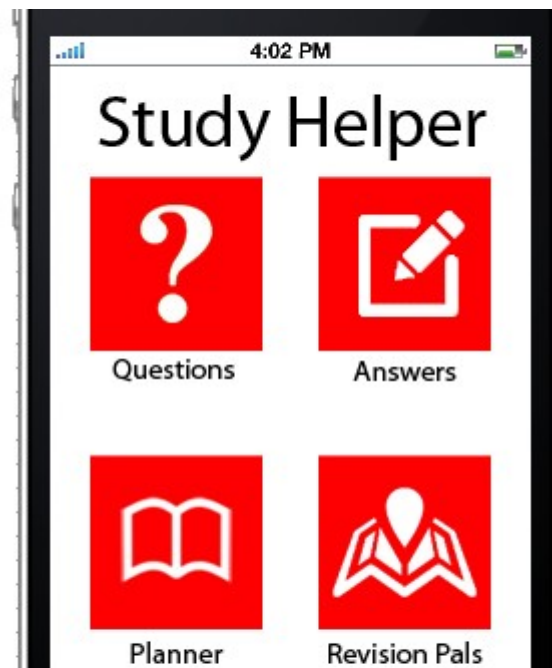
2

(ii) The programs used by robots are stored as *binary* instructions. State the name given to binary instructions.

1

20.

An app is being developed for students to use to revise for their examinations. The app will show example questions, worked answers, a study planner and the location of friends with the app who are studying the same subjects.



(a) The icons used in the app are stored using a *standard file format*.

(i) State a standard file format suitable for storing these images.

1

(ii) Explain why the file size of an icon will be smaller if the colour depth is reduced.

2

(b) The app is connected to an online database which allows users to share their locations with others.

(i) It is a principle of the Data Protection Act that data is held securely.

State one other principle of the Data Protection Act that the app company must comply with.

1

MARKS

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MARKS

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Some users complain that using tracking and using their location is an invasion of privacy.

(ii) State what the app must do before it collects this information.

1

Here is an example of data from the online database that stores data
(c) about users and their locations.

UserID	First Name	Last Name	Time Logged	Latitude	Longitude	LogID
7283	Charlie	Burton	2014/03/23 16:35	55.8546	-4.1625	231392
7283	Charlie	Burton	2014/03/23 21:10	55.8515	-4.1948	231393
7283	Charlie	Burton	2014/03/24 10:27	55.8624	-4.2544	231394
1998	Harry	Styles	2014/03/23 16:35	55.8602	-4.2900	231395
1998	Harry	Styles	2014/03/23 23:10	55.8590	-4.2575	231396
2231	Kerry	Brown	2014/03/24 12:19	55.8548	-4.2494	231397

This data is shown in a *flat-file database*. Describe two advantages
(i) of storing the same data in *linked tables*.

2

1.

2.

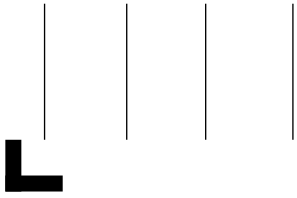
(ii) Two linked tables are created - USER and LOCATION.

Identify a suitable primary key for each table.

2

(iii) Explain the purpose of a *foreign key*.

1



Total Marks 10



21.

AnyLock is a lock that can be used in most doors. The lock is controlled by mobile app. The app is used to set a 4-digit code. When the code is entered and phone is held against the lock, the door will open.



MARKS

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(a) (i)

The details of the door and the pass code initially set up using the mobile app.

Using pseudocode or a language of your choice, show how a program could check that both pass codes are the same. When the two pass codes are the same a message is displayed saying "Pass Codes Set". If the pass codes do not match an error is displayed saying, "Pass Codes don't match".

3



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MARKS

(ii) Describe clearly, with reference to values and variables, what the following *pseudocode* does.

3

```
Line 1: SET roomlabel TO doorname_field
Line 2: IF len(roomlabel) = 0 THEN
Line 3:     SEND ['Invalid, try again] TO DISPLAY
Line 4: ELSE IF len(roomlabel) > 24 THEN
Line 5:     SET roomlabel TO substring(roomlabel, 24)
Line 6: END IF
```

Once a door and passcode are set on one mobile device the details can be automatically synced to other mobile devices.

(b) Describe how this could be achieved.

2



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MARKS

The app is compiled before it is made available for users of AnyLock. State **two** reasons why a compiler is used to translate the completed (c) program.

2

Total Marks 10

22. A computer program is used to record the number of visits a web page receives every hour in a day. The 24 totals are stored in an array of integers called "pagehits".

Using pseudocode or a programming language of your choice, write a short program, in the space below, to calculate the total number of web page (a) visits over the whole day.

3



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MARKS

The web server that stores the web page has special software on it that prevents some types of *Denial of Service (DOS) attacks*. The server keeps a list of banned computers. When any of these computers try to access the server the connection is refused.

(b)

3

The pseudocode below shows how the system checks the id of a computer against the list of banned ids.

```
Line 1: SET banned_list TO array_of_banned_ids
Line 2: SET id_to_check TO request_id
Line 3: SET on_banned_list TO FALSE
Line 4: FOREACH bad_id FROM banned_list DO
Line 5:   IF id_to_check = bad_id THEN
Line 6:     SET on_banned_list TO TRUE
Line 7:   END IF
Line 8: END FOREACH
```

Describe all the events that will occur if a request is received from a banned computer.

Describe why preventing access from certain computers can help prevent a *Denial of Service (DOS) attack*.

(c)

2



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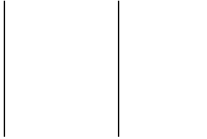
(d) Describe one other type of attack that can affect the security of a computer.

MARKS

2

Total Marks 10

[END OF QUESTION PAPER]



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