CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

COMPUTER SCIENCE **9608/01**

Paper 1 Theory Fundamentals **For Examination from 2015**

SPECIMEN PAPER

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

No marks will be awarded for using brand names for software packages or hardware.

No calculators allowed.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **16** printed pages.

1   A database is designed to store data about students at a college and the subjects which they study.

- All students are based in a tutor group.
- A tutor supervises all the students in their tutor group.
- Each subject has one subject teacher only.
- Students study a number of subjects.

This table `StudentSubjects` was a first attempt at the database design.

Table: `StudentSubjects`

StudentName	TutorGroup	Tutor	Subject	Level	SubjectTeacher
Tom	6	SAN	Physics	A	SAN
			Chemistry	A	MEB
			General Studies	AS	DIL
Joe	7	MEB	Geography	AS	ROG
			French	AS	HEN
Samir	6	SAN	Computer Science	A	VAR
			Chemistry	A	MEB
			Maths	A	COR
			General Studies	A	DIL

(a) (i) Explain why the table is **not** in First Normal Form (1NF).

[1]

(ii) Explain your answer by referring to the data.

[1]

(b) The design is changed to:

```
Student (StudentName, TutorGroup, Tutor)
StudentSubjectChoices (StudentName, Subject, Level, SubjectTeacher)
```

Using the data given in the first attempt table, show how this data is now stored in the revised table designs.

Table: `Student`

StudentName	TutorGroup	Tutor

Table: `StudentSubjectChoices`

StudentName	Subject	Level	SubjectTeacher

[3]

(c) (i) Explain what is meant by a primary key.

....

....

....

.... [2]

(ii) A student is **not** allowed to choose the same subject at A Level and AS.

What is the primary key of table `StudentSubjectChoices`?

.... [1]

(iii) There is a relationship between tables `Student` and `StudentSubjectChoices`.

Explain how the relationship is **established** using a primary key and foreign key.

....

....

....

.... [2]

(d) The design of table `StudentSubjectChoices` is:

`StudentSubjectChoices (StudentName, Subject, Level, SubjectTeacher)`

Explain why this table is **not** in Second Normal Form (2NF).

....

....

....

.... [2]

(e) The design of table `Student` is:

`Student (StudentName, TutorGroup, Tutor)`

Explain why this table is **not** in Third Normal Form (3NF).

....

....

....

.... [2]

2 When data is transmitted, it may become corrupted.

(a) Explain how a parity check can be used to detect a possible error in a transmitted byte.

....

....

....

....

....

.... [3]

(b) Describe how parity can be used to identify and correct the single error in this transmitted data block.

```
0  1  1  0  1  1  0  1
1  0  0  1  0  1  1  1
0  1  0  1  0  1  0  0
1  0  0  0  1  0  0  1
0  1  1  0  0  0  1  1
1  0  0  0  0  1  1  0
0  1  1  0  1  1  0  1
```
```
0  1  0  0  0  0  0  0
```
Parity byte

....

....

....

....

....

.... [3]

3 The table shows the assembly language instructions for a processor which has one general purpose register – the Accumulator.

Instruction		Explanation
Op Code	Operand	
LDD	<address>	load using direct addressing
STO	<address>	store the contents of the Accumulator at the given address
LDI	<address>	load using indirect addressing
LDX	<address>	load using indexed addressing
INC		add 1 to the contents of the Accumulator
END		end the program and return to the operating system

(a) Write on the diagram to explain the instruction shown.
Show the contents of the Accumulator after the execution of the instruction.

```
LDD 105
```

Accumulator

Main memory

100	0100 0000
101	0110 1000
102	1111 1110
103	1111 1010
104	0101 1101
105	0001 0001
106	1010 1000
107	1100 0001
200	1001 1111

[2]

(b) Write on the diagram to explain the instruction shown.
Show the contents of the registers after the execution of the instruction.

```
LDX 101
```

Accumulator

Index Register
0000 0011

Main memory

100	0100 0000
101	0110 1000
102	1111 1110
103	1111 1010
104	0101 1101
105	0001 0001
106	1010 1000
107	1100 0001
200	1001 1111

[4]

(c) Trace this assembly language program using the trace table.

```
500        LDD    507
501        INC
502        STO    509
503        LDD    508
504        INC
505        STO    510
506        END
507         22
508        170
509          0
510          0
```

| | Memory Address | | | |
Accumulator	507	508	509	510
	22	170	0	0

[5]

 [Turn over

4 The website www.checkyourwellbeing.com offers help and advice about personal well-being.

The website has a link – 'Calculate my BMI' – that users can click to work out their 'Body Mass Index'.

When the 'Calculate my BMI' link is clicked on the client computer, this webpage is requested.

```
1   <html>
2   <head>
3   <title>Body Mass Index</title>
4
5   </head>
6
7   <body>
8   Calculate my body mass index
9
10  <Script Language = "JavaScript">
11
12  var myWeight = prompt("Enter your weight (in kg.)", "");
13
14  var myHeight = prompt("Enter your height (in m.)", "");
15
16  var myBMI = myWeight / (myHeight * myHeight);
17  myBMI = myBMI.toFixed(2)
18
19  alert("My calculated BMI is ..." + myBMI) ;
20
21  if (myBMI < 18.5)
22  {
23      alert("UNDERWEIGHT") ;
24  }
25
26  if (myBMI > 25)
27  {
28      alert("OVERWEIGHT") ;
29  }
30  if (myBMI >=18.5 && myBMI<=25)
31  {
32      alert("WITHIN RANGE")
33  }
34
35  </Script>
36
37  </body>
38  </html>
```

Loading the webpage produced this sequence of dialogue boxes:
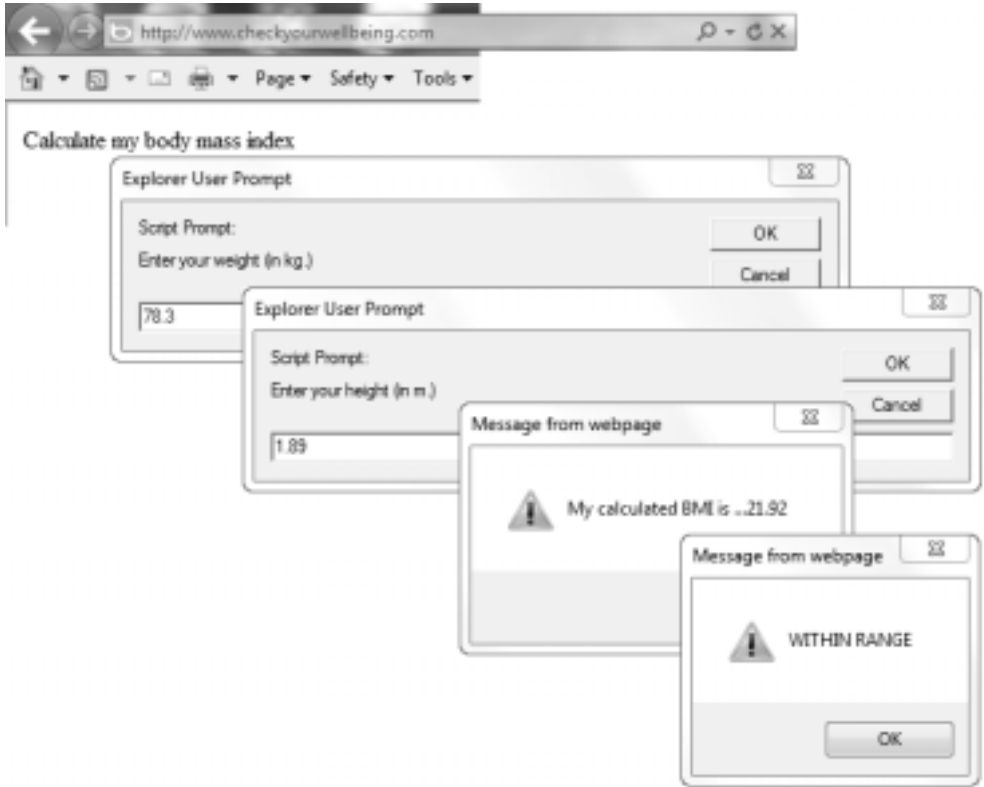
**(a)** Which lines in the webpage script are JavaScript code?

.... [1]

(b) (i) Give the identifiers of **two** variables which have been used by the programmer.

1 ....

2 .... [2]

(ii) What group of program statements are performing selection?

line number .... up to line number .... [1]

(c) By studying the web page script and its use, what is the use in JavaScript of:

(i) the `prompt` function?

....

.... [2]

(ii) the `alert` function?

....

.... [2]

(d) The diagram shows the client computer network with the connection to the Internet.

Client computer

X

Internet

Network file server

www.checkyourwellbeing.com
web server
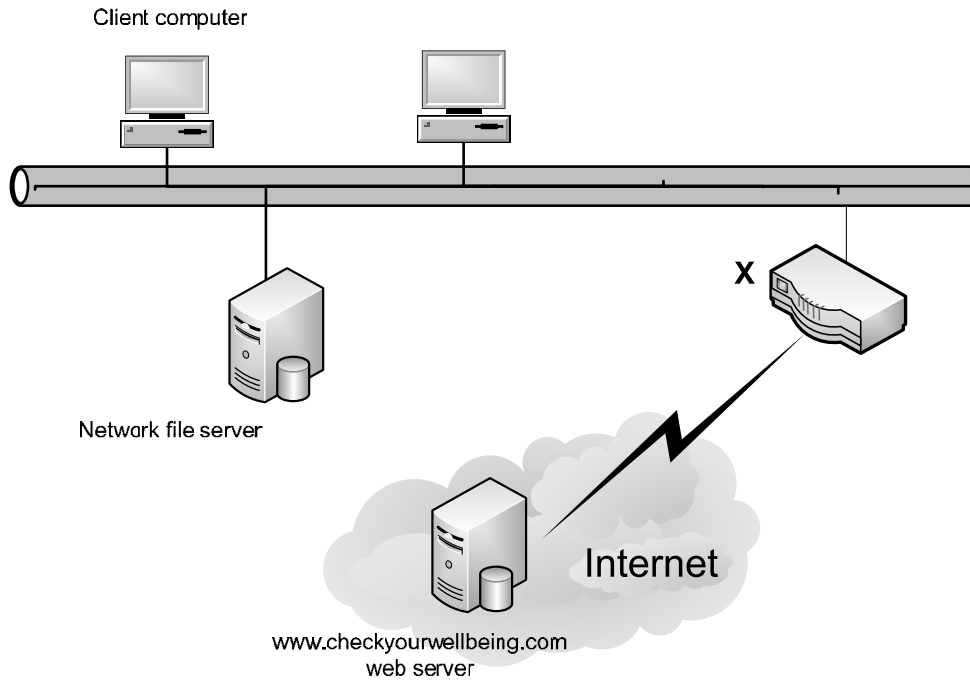
What is the hardware device labelled X?

.... [1]

(e) Put **five** of these statements in the correct sequence to describe how the content of the page shown is displayed by the client computer's browser software.

Two of the statements will **not** be used.

   A   The client computer processes the JavaScript code.

   B   The page content is transmitted to the client computer.

   C   The page is displayed on the client computer.

   D   The user clicks on the hyperlink and the web page is requested from the network file server.

   E   The web server processes the JavaScript code.

   F   The user clicks on the hyperlink and the web page is requested from the www.checkyourwellbeing.com web server.

   G   The server finds the web page.

The sequence is: (fill in the letters)

	⇨		⇨		⇨		⇨	
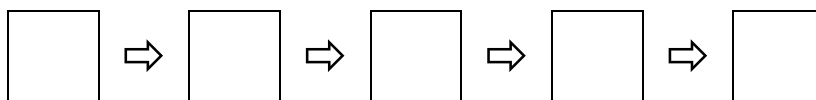
[5]

(f) How is this JavaScript code run?

  [1]

(g) The web developer tested the JavaScript code without involving the web server.

Explain how this is possible.

  [1]

5 Here are the contents of three memory locations with addresses shown in denary.

Address	Memory contents
150	0100 0111
151	1100 1101
152	1001 1100

(a) (i) What is the binary value for address 150?

.... [1]

(ii) What is the hexadecimal value for the contents of address 152?

.... [1]

(b) The numbers in location 151 and 152 are the height and width (in pixels) of a bitmap graphic currently in main memory. What are the dimensions of the bitmap in denary?

Height: ....pixels

Width: ....pixels [2]

(c) A bitmap graphic can be saved in a number of different image resolutions.

(i) How many bits are required to store each pixel for a black and white bitmap?

.... [1]

(ii) For a 256-colour bitmap, each pixel requires a byte of memory.
Explain this statement.

....

.... [2]

(iii) In addition to the pixel data values and its dimensions, what other information is stored in the bitmap file?

....

.... [2]

(iv) Bitmaps may use compression techniques to reduce the file size.

Explain the difference between 'lossless' and 'lossy' techniques for achieving this compression.
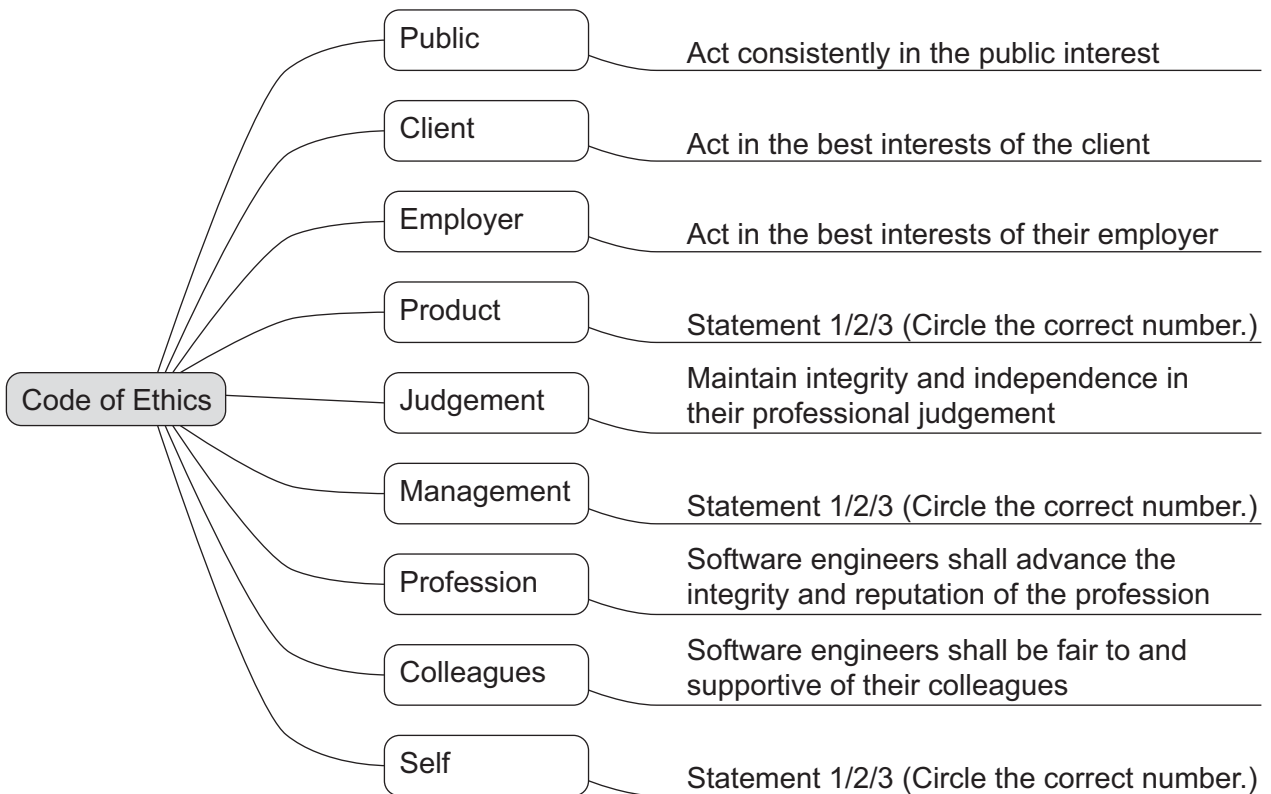
....

....

....

....

....

....

....

.... [4]

6 The ACM and IEEE set out eight principles for ethics and professional practice.

The categories, with a short explanation, are shown in this diagram.

	Public	Act consistently in the public interest
	Client	Act in the best interests of the client
	Employer	Act in the best interests of their employer
	Product	Statement 1/2/3 (Circle the correct number.)
Code of Ethics	Judgement	Maintain integrity and independence in their professional judgement
	Management	Statement 1/2/3 (Circle the correct number.)
	Profession	Software engineers shall advance the integrity and reputation of the profession
	Colleagues	Software engineers shall be fair to and supportive of their colleagues
	Self	Statement 1/2/3 (Circle the correct number.)

Statement 1
Team leaders should subscribe to and promote an ethical approach to the management of software development and maintenance.

Statement 2
Software engineers shall participate in lifelong learning regarding the practice of the profession.

Statement 3
Software and related modifications meet the highest possible standards.

(a) These **three** statements need to be added to the diagram.

Circle the correct numbers on the diagram to indicate the positions for Statement 1, Statement 2 and Statement 3. [2]

(b) For each of these three workplace scenarios, unethical behaviour is demonstrated.

Explain the principle(s) which are **not** being met.

(i) Workplace scenario 1

A large project is devolved to project teams, each led by a project leader. One project leader fails to inform his manager that he has major concerns that:

- their team's software contribution is taking much longer to write and test than anticipated
- they are consequently at risk of spending over their allocated budget.

[3]

(ii) Workplace scenario 2

The software house is about to train a number of programmers in a new programming language. Two employees are refusing to attend the training.

[2]

(iii) The company is developing some monitoring software which requires sensors placed in a nature reserve. One employee considers the sensors will be a danger to some of the wildlife, but is told by his manager that the matter is none of his concern.

[2]

7 (a) Complete the table to show the outputs for the possible inputs to this circuit.
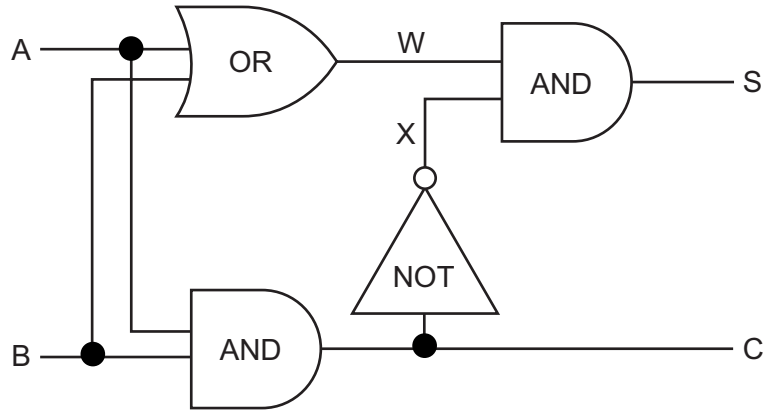
A	B	W	X	C	S
0	0				
0	1				
1	0				
1	1				

[5]

(b) State a possible use for this circuit in a processor.

....

.... [1]