Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMPUTER SCIENCE **9608/32**

Paper 3 Advanced Theory **May/June 2017**

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
No marks will be awarded for using brand names of software packages or hardware.

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.

The maximum number of marks is 75.

This document consists of **14** printed pages and **2** blank pages.

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1 **(a)** Consider the following pseudocode user-defined data type:

```
TYPE MyContactDetail
   DECLARE Name        : STRING
   DECLARE HouseNumber : INTEGER
ENDTYPE
```

(i) Write a pseudocode statement to declare a variable, `NewFriend`, of type `MyContactDetail`.

.....[1]

(ii) Write a pseudocode statement that assigns 129 to the `HouseNumber` of `NewFriend`.

.....[1]

(b) The user-defined data type `MyContactDetail` needs to be modified by:

- adding a field called `Area` which can take three values, uptown, downtown or midtown
- amending the field `HouseNumber` so that house numbers can only be in the range 1 to 499.

Write the updated version of `MyContactDetail`.

.....

.....

.....

.....

.....

.....

.....[3]

(c) A pointer is a variable that stores the address of a variable of a particular type.

Consider the pseudocode on page 3, which uses the following identifiers:

Identifier	Data type	Description
`IPointer`	`^INTEGER`	pointer to an integer
`Sum`	`INTEGER`	an integer variable
`MyInt1`	`INTEGER`	an integer variable
`MyInt2`	`INTEGER`	an integer variable

```
Sum ← 91              // assigns the value 91 to the integer variable Su...
IPointer ← @Sum       // assigns to IPointer the address of the
                      // integer variable Sum
MyInt1 ← IPointer^    // assigns to variable MyInt1 the value at an
                      // address pointed at by IPointer
IPointer^ ← MyInt2    // assigns the value in the variable MyInt2 to
                      // the memory location pointed at by IPointer
```

The four assignment statements are executed. The diagram shows the memory contents after execution.

Variable	Memory Address	Contents
	...	
	5848	
	5847	
IPointer	5846	4402
	5845	
	...	
	4403	
Sum	4402	33
	4401	
	...	
	3428	
MyInt1	3427	91
MyInt2	3426	33
	3425	
	...	

Use the diagram to state the current values of the following expressions:

(i) `IPointer` .....[1]

(ii) `IPointer^` .....[1]

(iii) `@MyInt1` .....[1]

(iv) `IPointer^ = MyInt2` .....[1]

(d) Write pseudocode statements that will achieve the following:

(i) Place the address of `MyInt2` in `IPointer`.

.....[1]

(ii) Assign the value `33` to the variable `MyInt1`.

.....[1]

(iii) Copy the value in `MyInt2` into the memory location currently pointed at by `IPointer`.

.....[1]

2 The following incomplete table shows descriptions and terms relating to malware.

(a) Complete the table with appropriate description and terms.

	Description	Term	
(i)	Malicious code is installed on a personal computer so that the user is misdirected to a fraudulent web site without their knowledge.	.....	[1]
(ii)	An attempt to acquire sensitive information, often for malicious reasons, by trying to deceive the user through the contents of an email.	.....	[1]
(iii)	....	Worm	[2]

(b) State **two** vulnerabilities that the malware in **part (a)(i)** or **part (a)(ii)** can exploit.

Vulnerability 1 .....

.....

Vulnerability 2 .....

.....

[2]

(c) Digital certificates are used in internet communications. A Certificate Authority (CA) is responsible for issuing a digital certificate.

The digital certificate contains a digital signature produced by the CA.

(i) Name **three** additional data items present in a digital certificate.

1 .....

2 .....

3 .....

[3]

(ii) Describe how the digital signature is produced by the CA.

.....

.....

.....

.....

.....

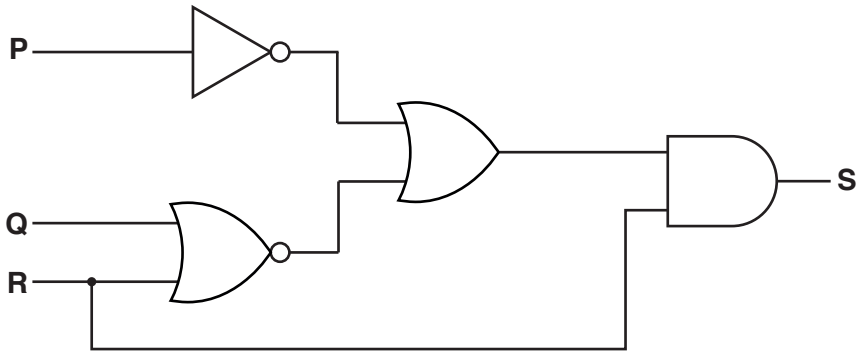
.....[3]

(iii) Give the reason for including a digital signature in the digital certificate.

.....

.....[1]

3 A logic circuit is shown:



(a) Write the Boolean algebraic expression corresponding to this logic circuit:

S = ...[4]

(b) Complete the truth table for this logic circuit:

P	Q	R	Working space	S
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

(c) **(i)** Complete the Karnaugh Map (K-map) for the truth table in **part (b)**.

		PQ			
		00	**01**	**11**	**10**
R	**0**				
	1				

[1]

The K-map can be used to simplify the function in **part (a)**.

(ii) Draw loop(s) around appropriate groups to produce an optimal sum-of-products. [1]

(iii) Write a simplified sum-of-products expression, using your answer to **part (ii)**.

S = ...[1]

(d) One Boolean identity is:

$$(A + B) \,.\, C = A \,.\, C + B \,.\, C$$

Simplify the expression for S in **part (a)** to the expression for S in **part (c)(iii)**.

You should use the given identity and De Morgan's Laws.

.....

.....

.....

.....

.....

.....

.....

.....[3]

4 **(a)** Three file organisation methods and two file access methods are shown below.

Draw lines to link each file organisation method to its appropriate file access method(s).

File organisation method	File access method
random	sequential
serial	direct
sequential	

[4]

(b) An energy company supplies electricity to a large number of customers. Each customer has a meter that records the amount of electricity used. Customers submit meter readings using their online account.

The company's computer system stores data about its customers.

This data includes:

- account number
- personal data (name, address, telephone number)
- meter readings
- username and encrypted password.

The computer system uses three files:

File	Content	Use
A	Account number and meter readings for the current month.	Each time a customer submits their reading, a new record is added to the file.
B	Customer's personal data.	At the end of the month to create a statement that shows the electricity supplied and the total cost.
C	Usernames and encrypted passwords.	When customers log in to their accounts to submit meter readings.

For each of the files A, B and C, state an appropriate file organisation method for the use given in the table.

All three file organisation methods must be different.

Justify your choice.

(i) File A organisation .....

Justification .....

.....

.....

.....[3]

(ii) File B organisation .....

Justification .....

.....

.....

.....[3]

(iii) File C organisation .....

Justification .....

.....

.....

.....[3]

5 The TCP/IP protocol suite can be viewed as a stack with four layers.

(a) Complete the stack by inserting the names of the three missing layers.

Application layer

[3]

(b) BitTorrent is a protocol used at the Application layer for the exchange of data.

(i) State the network model used with this protocol.

.....[1]

(ii) State the use of BitTorrent.

.....[1]

(iii) Explain how the exchange of data is achieved using BitTorrent.

.....

.....

.....

.....

.....

.....

.....

.....[4]

(c) State **two** additional protocols that are also used at the Application layer for the exchange of data.

For each protocol, give an example of an appropriate exchange of data.

Protocol 1 .....

Example .....

.....

Protocol 2 .....

Example .....

.....

[4]

6 A large office building has many floors. On each floor there are security sensors and security cameras. There is the same number of sensors on each floor. The building has a single security room.

The images from the security cameras are output on monitors (one monitor for each floor) placed in the security room.

The data from the sensors are read and processed by a computer system. Sensor readings and warning messages can be displayed on the monitors.

(a) (i) State the name given to the type of system described.

.....[1]

(ii) Explain your answer to **part (i)**.

.....

.....[1]

(iii) State **two** sensors that could be used in this system.

Sensor 1 .....

Sensor 2 .....

[2]

(b) A software routine:

- checks the readings from the sensors
- outputs readings and warning messages to the monitors
- loops continuously.

The routine uses the following pseudocode variables:

Identifier	Data type	Description
`FloorCounter`	`INTEGER`	Loop counter for number of floors
`SensorCounter`	`INTEGER`	Loop counter for number of sensors
`NumberOfFloors`	`INTEGER`	Stores the number of floors
`NumberOfSensors`	`INTEGER`	Stores the number of sensors
`ForEver`	`BOOLEAN`	Stores value that ensures continuous loop

(i) Complete the following pseudocode algorithm for the routine.

```
01 ForEver ← .....
02 REPEAT
03   FOR FloorCounter ← 1 TO NumberOfFloors
04     FOR SensorCounter ← 1 TO .....
05       READ Sensor(SensorCounter)on Floor(FloorCounter)
06       IF Sensor value outside range
07          THEN
08             OUTPUT "Problem on Floor ", FloorCounter
09       ENDIF
10     ENDFOR
11   ENDFOR
12   //
13   // Delay loop
14   // Delay loop
15   //
16 UNTIL .....
```

[3]

(ii) A delay needs to be introduced before the loop is processed again.

Write a `FOR` loop, in pseudocode, to replace lines `13` and `14`.

.....

.....[1]

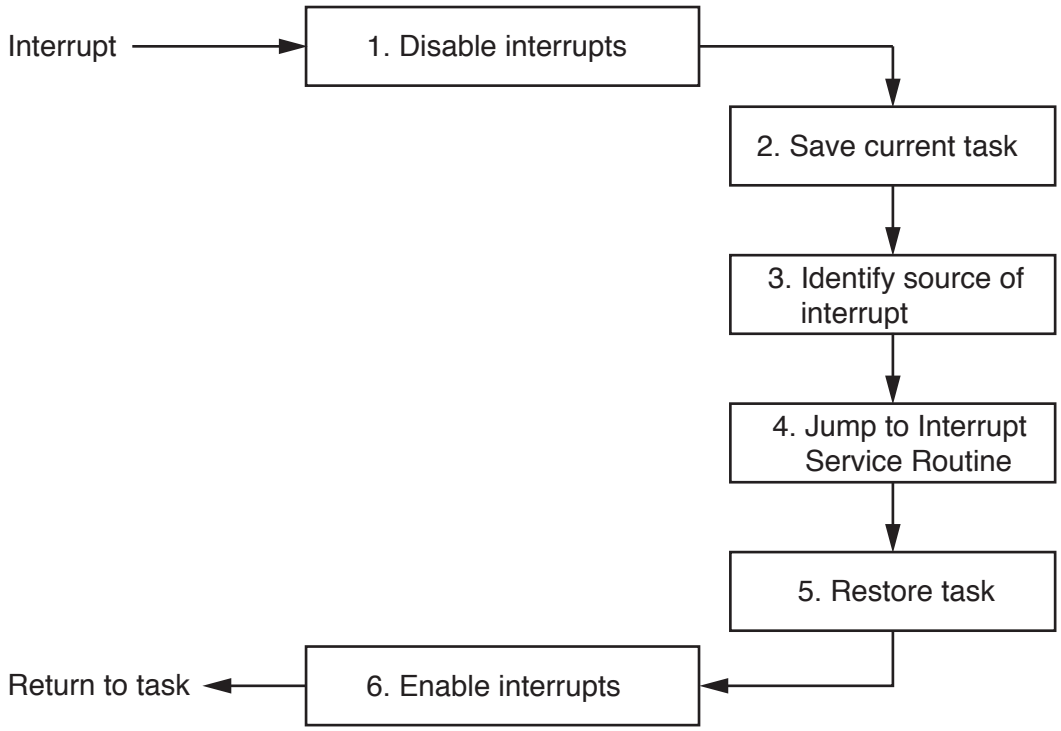
(iii) Give a reason for this delay in the system.

.....

.....[1]

(c) An alternative method of reading and processing sensor data is to use interrupts. Each sensor is connected so that it can send an interrupt signal to the processor if its value changes.

On receipt of an interrupt signal, the processor carries out a number of steps as shown in the following diagram.



(i) State the purpose of step 3.

.....

.....[1]

(ii) Explain what happens at step 4.

.....

.....

.....

.....[2]

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