Cambridge International AS & A Level

CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

COMPUTER SCIENCE **9618/11**

Paper 1 Theory Fundamentals **October/November 2021**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

[Turn over

1 (a) Draw **one** line from each binary value to its equivalent (same) value on the right.

Binary value
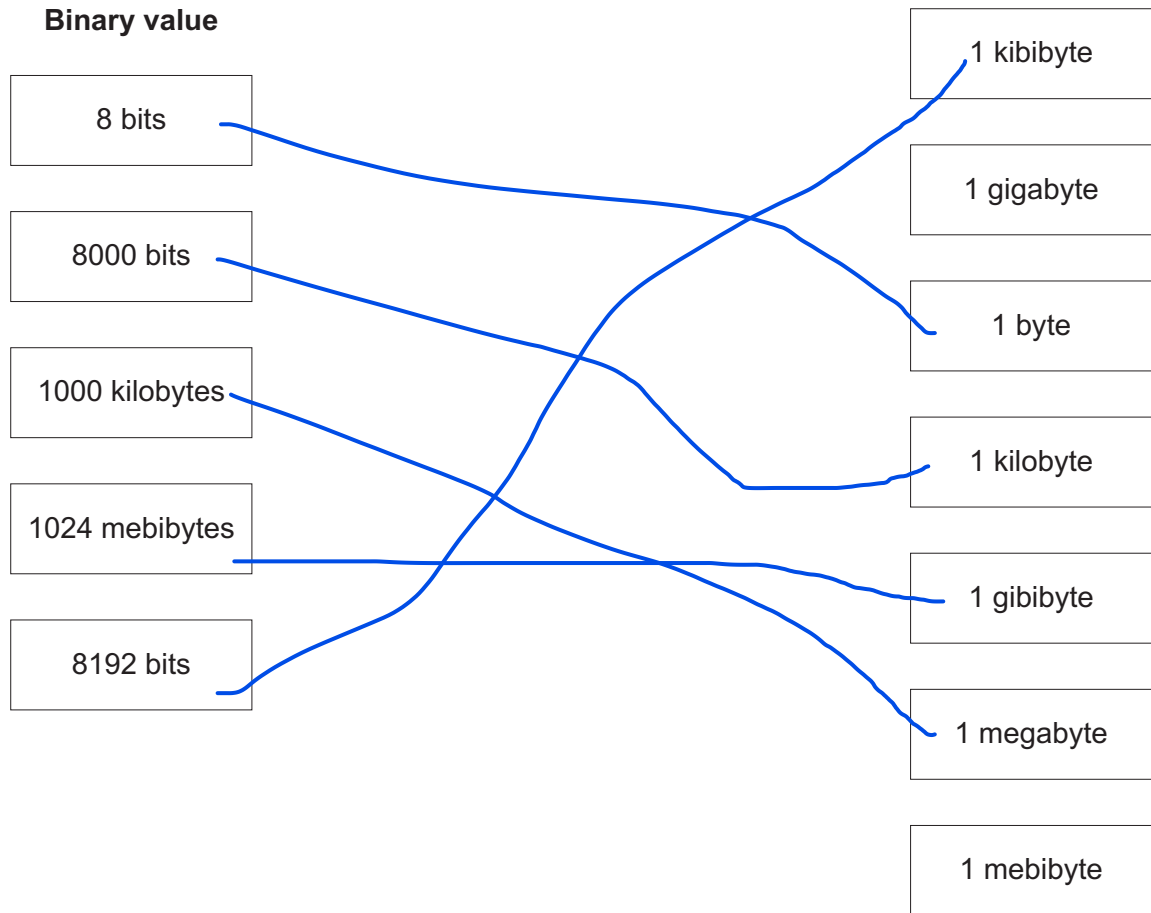
[5]

(b) (i) Perform the following binary addition. Show your working.

$$10101010$$
$$+ \ 00110111$$
$$11100001$$

[2]

(ii) State how an overflow can occur when adding two binary integers.

The result is a larger number than can be stored in the given number of bits. // The result is greater than 255

[1]

(c) Convert the hexadecimal value F0 into denary.

240

[1]

2 Xanthe wants to maintain the integrity and security of data stored on her computer.

(a) Explain the difference between data security and data integrity.

- security is protecting data from loss / corruption
- integrity is ensuring the consistency / accuracy of the data

.... [2]

(b) Xanthe uses both data validation and data verification when entering data on her computer.

(i) Describe how data validation helps to protect the integrity of the data. Give an example in your answer.

Description ....

- validation checks that data is reasonable / sensible
- example e.g. checking data is the right number / type of characters

Example ....
[2]

(ii) Describe how data verification helps to protect the integrity of the data. Give an example in your answer.

Description ....

- verification checks that data is the same as the original
- by example e.g. double entry

Example ....
[2]

(c) Two malware threats are spyware and viruses.

Give **two** similarities and **one** difference between spyware and a virus.

- Both are pieces of malicious software
- Both are downloaded / installed/run without the user's knowledge
- Both can pretend to be / are embedded in other legitimate software when downloaded // both try to avoid the firewall
- Both run in the background

- Virus can damage computer data; spyware only records / accesses data
- Virus does not send data out of the computer; spyware sends recorded data to third party
- Virus replicates itself; spyware does not replicate itself

[3]

3   A logic circuit is shown:
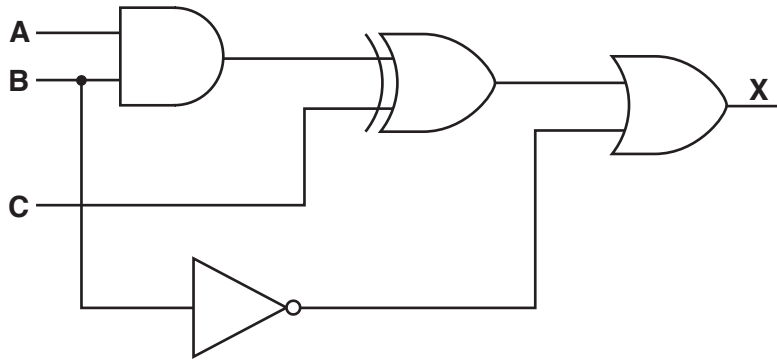
(a)   Write the logic expression for the logic circuit.

((A AND B) XOR C) OR NOT B

....

.... [3]

(b)   Complete the truth table for the given logic circuit.

A	B	C	Working space	X
0	0	0		1
0	0	1		1
0	1	0		0
0	1	1		1
1	0	0		1
1	0	1		1
1	1	0		1
1	1	1		0

[2]

(c) Identify **one** logic gate **not** used in the given logic circuit. Draw the symbol for the logic gate **and** complete its truth table.

Logic gate: ……NAND……………………….

Symbol:

Truth table:

A	B	Output
0	0	1
0	1	1
1	0	1
1	1	0

[3]

4 Francis is starting his first job as a software developer for a multinational company.

(a) Francis has been advised to join a professional ethical body.

Describe the benefits to Francis of joining a professional ethical body.

- He has ethical guidelines to follow
  - … so clients/other staff know the standards being applied
  - … so he does not have to decide what is ethical it's written down
- Clients / staff know he is reputable
  - … recognition of his skills / knowledge
  - … there may be a test / requirements for entry
- They provide help and support
  - … for example if he needs legal advice
- They run training courses
  - … to keep his skills up-to-date   [3]

(b) Francis is shown the software he will be working on. He is unfamiliar with the Integrated Development Environment (IDE) he is required to use.

(i) Describe the ways in which Francis can act ethically in this situation.

- He can tell the manager he has not used it … and how he will get up-to-date
- He can perform his own research on how to use it
- He can explain to the manager that he needs additional training
- He can(ask the manager to book on a training course
- He can ask for a mentor / to shadow someone
- He can practice at home before starting   [2]

(ii) A typical IDE provides debugging tools to support the testing of a program.

Identify **three** other tools or features found in a typical IDE to support the writing of the program.

- Colour coding // pretty printing
- Auto-complete
- Auto-correct
- Context sensitive prompts
- Expand and collapse code blocks   [3]

(c) Francis is part of a team writing a program. He finds an error in part of the program that has already been tested. He decides not to tell anyone because he is worried about the consequences.

Explain the reasons why Francis acted unethically in this situation.

- He didn't act in best interest of product
- … because the product might fail because he didn't report the error
- He didn't act in best interest of client
- … because if the product does not work then they have been let down because he didn't report the error
- He didn't act in the best interest of the profession
- … he is letting his profession down because he didn't report the error
- He didn't act in best interest of the company
- ... not correcting the error early could lead to later problems

(d) Francis's team use language translators.

Complete the descriptions of language translators by writing the missing words.

...Compilers... are usually used when a high-level language program is complete. They translate all the code at the same time and then run the program.

They produce ...executable/ object code... files that can be run without the source code.

...Interpreters... translate one line of a high-level language program at a time, and then run that line of code. They are most useful while developing the programs because errors can be corrected and then the program continues from that line.

Assemblers are used to translate assembly code into ...Binary/ Machine Code... .

[4]

[Turn over

5 Javier owns many shops that sell cars. He employs several managers who are each in charge of one or more shops. He uses the relational database CARS to store the data about his business.

Part of the database is shown:

SHOP(ShopID, ManagerID, Address, Town, TelephoneNumber)

MANAGER(ManagerID, FirstName, LastName, DateOfBirth, Wage)

CAR(RegistrationNumber, Make, Model, NumberOfMiles, ShopID)

(a) Tick (✓) **one** box in each row to identify whether each field is a primary key or a foreign key.

Table	Field name	Primary key	Foreign key
MANAGER	ManagerID	●	
SHOP	ManagerID		●
CAR	RegistrationNumber	●	
CAR	ShopID		●

[2]

(b) Describe the ways in which access rights can be used to protect the data in Javier's database from unauthorised access.

- Access rights give managers / himself access to different elements
- … by having different accounts / logins
- … which have different access rights e.g. read only // no access / read / write
- Specific views can be assigned to himself and to the managers
- … e.g. managers can only see the data for their own shop(s)

[3]

(c) Javier uses Data Definition Language (DDL) and Data Manipulation Language (DML) statements in his database.

(i) Complete the following DML statements to return the number of cars for sale in each shop.

SELECT COUNT(...............RegistrationNumber..................)

FROM ....CAR...............................

.......GROUP BY................................. ShopID

[3]

(ii) Complete the DML statement to include the following car in the table CAR.

Field	Data
RegistrationNumber	123AA
Make	Tiger
Model	Lioness
NumberOfMiles	10500
ShopID	12BSTREET

.....INSERT.......... .....INTO.......... CAR

.....VALUES........ ("123AA","Tiger","Lioness",10500,"12BSTREET")

[2]

BLANK PAGE

6 (a) There are **two** errors in the following register transfer notation for the fetch-execute cycle.

```
1   MAR ←[PC]

2   PC ← [PC] – 1

3   MDR ← [MAR]

4   CIR ← [MDR]
```

Complete the following table by:

- identifying the line number of each error
- describing the error
- writing the correct statement.

Line number	Description of the error	Correct statement
2	Program Counter should be incremented, not decremented	PC <- [PC] + 1
3	It should be the contents of the address in the MAR	MDR <- [[MAR]]

[4]

(b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store the contents of ACC at the given address
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end

<address> can be an absolute or symbolic address
\# denotes a denary number, e.g. #123
B denotes a binary number, e.g. B01001101

The current contents of main memory are shown:

Address	Data
100	00001111
101	11110000
102	01010101
103	11111111
104	00000000

Each row of the following table shows the current contents of ACC in binary and the instruction that will be performed on those contents.

Complete the table by writing the new contents of the ACC after the execution of each instruction.

Current contents of the ACC	Instruction	New contents of the ACC
11111111	OR 101	11111111
00000000	XOR #15	00001111
10101010	LSR #2	00101010
01010101	AND 104	00000000

[4]

7 Bobby is recording a sound file for his school project.

(a) He repeats the recording of the sound several times, with a different sample rate each time.

(i) Describe the reasons why the sound is closer to the original when a higher sample rate is used.

- Smaller time gaps between the samples
- Makes the digital sound wave more accurate
- Smaller quantisation errors

.... [2]

(ii) Describe the reasons why the sound file size increases when a higher sample rate is used.

- More samples/data are taken/recorded
- … so more bits are stored altogether

.... [2]

(b) Bobby wants to email the sound file to his school email address. He compresses the file before sending the email.

(i) Explain the reasons why Bobby compresses the sound file.

- Reduces the file size
- Faster to transmit/download
- Original file is too large for email storage/attachment

.... [2]

(ii) Bobby uses lossless compression.

Describe how lossless compression can compress the sound file.

- Reduce amplitude to only the range used
- … limited amplitudes mean fewer bits per sample
- Run-length-encoding
- … Where consecutive sounds are the same record the binary value of the sound and number of times it repeats
- Record the changes instead of the actual sounds

[2]

8 A school is setting up a network within one of its buildings.

(a) State whether the network will be a LAN (local area network) or a WAN (wide area network). Justify your choice.

- LAN
- Small geographical area
- No leasing external infrastructure / transmission media
  // does not use internet to transmit within the building

.... [3]

(b) One classroom in the building has 30 computers. The computers need to be connected to the network. Each computer has a network interface card (NIC).

Identify **two** possible devices that can be used to physically connect the 30 computers to the rest of the network.

- router - switch - hub

1 ....

2 ....

[2]

(c) The school has several laptops. Each laptop has a Wireless Network Interface Card (WNIC).

Describe the functions of a Wireless Network Interface Card.

- Provide interface to wireless network … as an antenna
- Receives analogue radio waves
  … convert them to digital / binary
- Checks incoming transmissions for correct MAC / IP address
  … ignore transmissions not intended for it
- Encrypts / encodes the data   - Decrypts / decodes the data
- Takes digital/binary input and converts to analogue waves
  … sends the radio waves via the antenna

[4]

BLANK PAGE