Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7938385792

COMPUTER SCIENCE **9618/11**

Paper 1 Theory Fundamentals **May/June 2022**

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.

1 Computers store data in binary form.

(a) State the difference between a tebibyte and a terabyte.

One tebibyte is 1024 gibibytes and one terabyte is 1000 gigabytes

..... [1]

(b) Convert the signed denary value –100 into an 8-bit two's complement binary integer.

Working .....

.....

Answer 1001 1100 [1]

(c) Convert the denary number 251 into hexadecimal. Show your working.

Working .....

.....

.....

.....

Answer FB

[2]

(d) Add the following unsigned binary integers.

```
  0 1 0 1 0 0 0 0
+ 0 0 1 1 1 1 1 0
-----------------
  1000 1110
```

[1]

2 A computer has hardware and software.

(a) The hardware includes different types of memory.

(i) Complete the description of computer memory.

Random Access Memory (RAM) and Read Only Memory (ROM) are both examples of

primary memory.

One item that is stored in RAM is currently running software/data/part of OS .

One item that is stored in ROM is the start-up/boot-up instructions/BIOS .

RAM can be either Static RAM (SRAM) or Dynamic RAM (DRAM).

SRAM uses transistors arranged as flip-flops/latches .

DRAM uses transistors and capacitors .

[5]

(ii) Explain the difference between Programmable ROM (PROM), Erasable Programmable ROM (EPROM) and Electrically Erasable Programmable ROM (EEPROM).

PROM can be set once, EPROM and EEPROM can be overwritten multiple times.

EPROM needs to be removed from device

EEPROM can be erased in situ.

EPROM and can be erased using UV light, EEPROM can be erased using voltage // is flash storage.

EPROM must be entirely erased before rewriting, EEPROM does not have to be entirely erased before rewriting.

[3]

(b) A magnetic hard disk is used to store data on the computer.

Describe the principal operations of a magnetic hard disk.

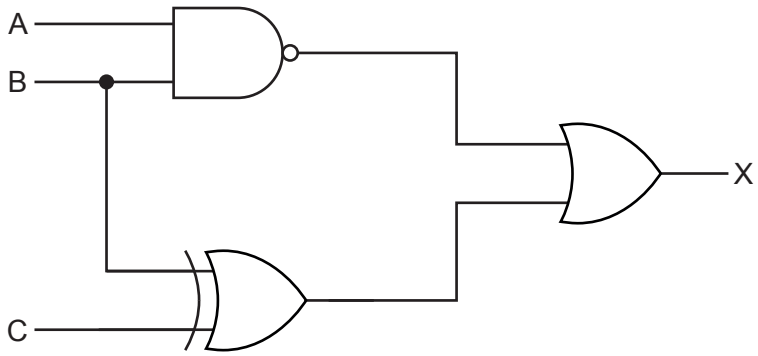
(c) Computers consist of logic gates.

(i) Complete the table by writing **one** set of values (input 1 and input 2) for each gate that will give the output 1.

Gate	Input 1	Input 2	Output
AND	1	1	1
NAND	0 / 0 / 1	0 / 1 / 0	1
XOR	0 / 1	1 / 0	1
NOR	0	0	1

[4]

(ii) Write the logic expression for the given logic circuit.



(A NAND B) OR (B XOR C)

..... [3]

3 A teacher is writing examination papers on a laptop computer. The computer is connected to the internet. The teacher is concerned about the security and privacy of the papers.

(a) State the difference between the security of data and the privacy of data.

Security prevents against loss while privacy prevents unauthorised access

[1]

(b) Identify **and** describe **two** threats to the data. Identify **one** security measure to protect against each threat. Each security measure must be different.

Threat 1 Malware

Description Malicious software that replicates and can delete/damage the examination papers

Security measure Install and run anti-malware

Threat 2 Hacker/unauthorised access

Description Illegal access in order to delete/damage the examination papers

Security measure Use a firewall // strong passwords

[6]

4 A teacher uses a relational database, MARKS, to store data about students and their test marks.

The database has the following structure:

STUDENT(StudentID, FirstName, LastName)

TEST(TestID, Description, TotalMarks)

STUDENT_TEST(StudentID, TestID, Mark)

(a) Describe the advantages of using a relational database compared to a file-based approach.

Reduced data redundancy // less repeated data

Maintains data consistency // improves data integrity

Program-data independence

Complex queries are easier to run

Can provide different views

[4]

(b) Give the highest level of Normal Form (NF) the database MARKS is in **and** justify your choice.

Normal Form 3NF

Justification There are no repeated attributes // it is already in 2NF.

Each field is fully dependent on the corresponding primary key // no partial dependencies. No transitive dependencies

[3]

(c) (i) Sample data to be stored in the table `STUDENT_TEST` is shown.

StudentID	TestID	Mark
12	A1	50
12	P10	100
13	A1	75
14	P10	60

Write a Structured Query Language (SQL) script to create the table `STUDENT_TEST`.

```
CREATE TABLE STUDENT_TEST (
   StudentId INTEGER,
   TestID VARCHAR,
   Mark INTEGER,
   PRIMARY KEY(StudentID,TestID),
   FOREIGN KEY(TestID) REFERENCES
TEST(TestID),
   FOREIGN KEY(StudentID) REFERENCES
STUDENT(StudentID)
);
```

[5]

(ii) Write a Structured Query Language (SQL) script to find the average mark of students in test A7.

```
SELECT AVG(Mark)
FROM STUDENT_TEST
WHERE TestID = "A7";
```

[3]

(d) The mark a student is awarded in a test will be entered into the database. This mark needs to be a whole number between 0 and the maximum number of marks for that test (inclusive).

Explain how data validation **and** data verification can be used when a mark is entered.

Validation

Range check to make sure it is between 0 and max marks

Presence check to make sure a mark is entered

Type check to make sure an integer value is entered

Verification

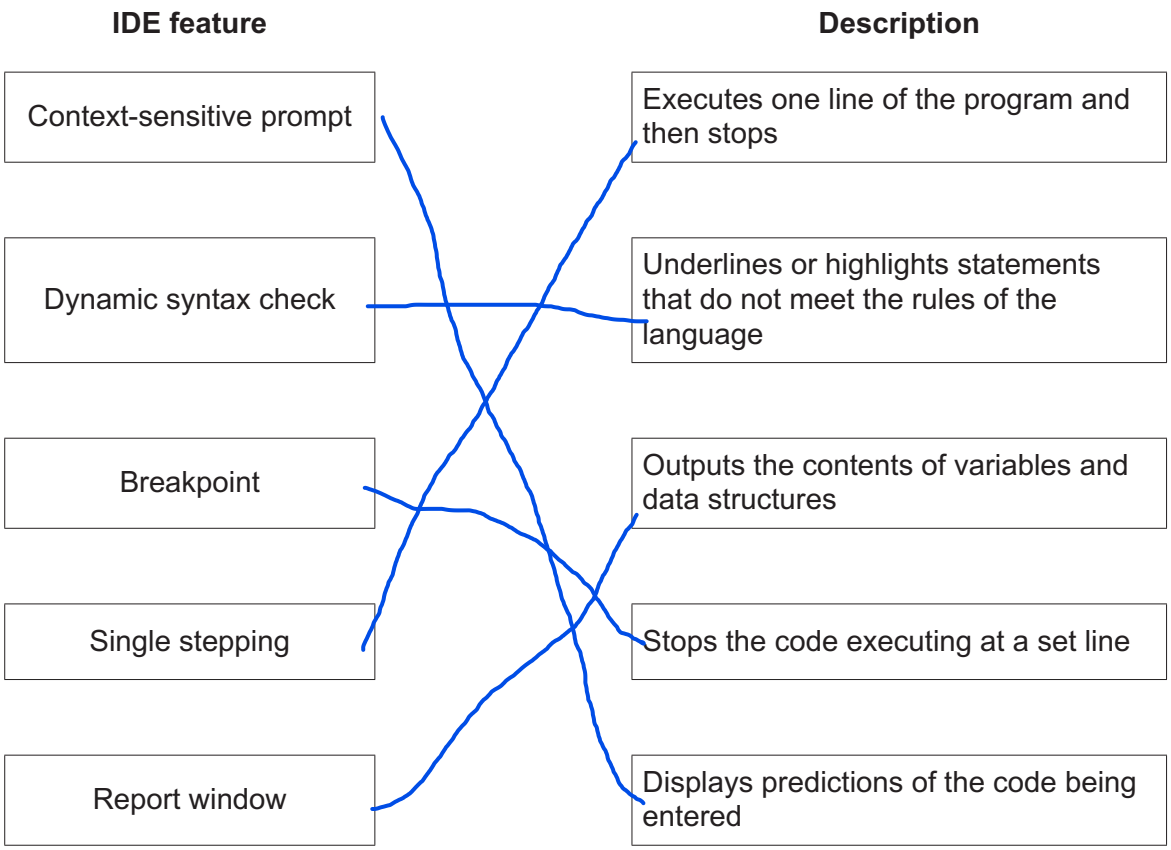
Double entry - enter the mark twice and the computer compares them

[4]

visual check – manually compare the mark entered with the mark on the input document

5 A programmer uses an Integrated Development Environment (IDE) to develop a program.

(a) Draw **one** line from each IDE feature to its correct description.



[4]

(b) The programmer wants to allow users to edit, improve and redistribute the program.

Identify **two** different types of software licence that the programmer could use.

1 Open Source Initiative .....

2 Free Software Foundation .....

[2]

(c) Explain the benefits to the programmer of using program libraries.

Saves (programming/testing) time as code does not have to be written/re-written from scratch // code does not have to be tested.

Code is already tested so it is more robust/likely to work.

If there is an improvement in the library routine the program updates automatically.

can perform complex calculations that the programmer may be unable to do.

..... [3]

6 **(a)** A computer system is designed using the basic Von Neumann model.

(i) Describe the role of the registers in the Fetch-Execute (F-E) cycle.

The Program Counter (PC) holds the address of the next instruction and the contents are incremented / changed to the next address each cycle

The Memory Address Register (MAR) holds the address to fetch the data (from the PC)

The Memory Data Register (MDR) holds the data at the address in MAR

The instruction is transferred to Current Instruction Register (CIR) for decoding and execution

[5]

(ii) Describe when interrupts are detected in the F-E cycle **and** how the interrupts are handled.

Detected At the start/end of a FE cycle

Handled Priority is checked

If lower priority than current process continue with F-E cycle

If higher priority than current process state of current process is / registers are stored on stack.

Location / type of interrupt identified...

…appropriate ISR is called to handle the interrupt

When ISR finished, check for further interrupts (of high priority) / return to step 1

Otherwise load data from stack and continue with process

[5]

(b) Identify **one** factor that can affect the performance of the computer system **and** state how it impacts the performance.

Factor Clock Speed .....

Impact higher clock speed means more FE cycles per second .....

.....

.....

[2]

Number of cores

more cores mean more instructions can be carried out simultaneously

Bus width

allows the transfer of more data each time // allows more memory locations to be directly accessed

Cache

the higher capacity the more frequently used instructions it can store for fast access

Question 6 continues on the next page.

(c) The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	**Operand**	
`AND`	`#n`	Bitwise AND operation of the contents of ACC with the operand
`XOR`	`#n`	Bitwise XOR operation of the contents of ACC with the operand
`OR`	`#n`	Bitwise OR operation of the contents of ACC with the operand
`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
# denotes a denary number, e.g. #123		

(i) Complete the register to show the result **after** the instruction `AND #2` is executed.

Register before:	0	1	1	0	1	1	0	1
Register after:	0	0	0	0	0	0	0	0

[1]

(ii) Complete the register to show the result **after** the instruction `OR #8` is executed.

Register before:	0	1	1	0	1	1	0	1
Register after:	0	1	1	0	1	1	0	1

[1]

(iii) Complete the register to show the result **after** the operation `LSL #4` is executed.

Register before:	0	1	1	0	1	1	0	1
Register after:	1	1	0	1	0	0	0	0

[1]

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