



ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Advanced Level

COMPUTER SCIENCE
PAPER 2 Practical

6023/2

NOVEMBER 2018 SESSION

3 hours

Additional materials:

CD

Printing facility

TIME 3 hours

INFORMATION FOR CANDIDATES

This is a purely practical examination. All answers should be printed. Handwritten answers will **not** be marked.

This paper consists of **three** sections.

- | | |
|-----------|----------|
| Section A | 20 marks |
| Section B | 50 marks |
| Section C | 30 marks |

Answer **one** question from each section.

Each answer sheet should include the following information in the header section:

- Candidate Name and Candidate Number
- Centre Name and Date
- Subject Name
- Subject Code

All work should be backed up by a soft copy on a CD. If you print more than one sheet, fasten them together. All answers should be correctly and clearly numbered.

This question paper consists of 10 printed pages and 2 blank pages.

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Section A [20 marks]

Answer any **one** question from this section.

- 1 (a) A system is monitored using sensors. The sensors output binary values corresponding to physical conditions as shown in the table.

Parameter	Description of parameter	Binary value	Description of condition
P	oil pressure	1	pressure \geq 3 bar
		0	pressure $<$ 3 bar
T	temperature	1	temperature \geq 200 °C
		0	temperature $<$ 200 °C
R	rotation	1	rotation \leq 1 000 revs per minute (rpm)
		0	rotation $>$ 1 000 revs per minute (rpm)

The outputs of the sensors form the inputs to a logic circuit. The output from the circuit X is 1, if any of the following conditions occur:

either oil pressure \geq 3 bar and temperature \geq 200 °C or oil pressure $<$ 3 bar and rotation $>$ 1 000 rpm or temperature \geq 200 °C and rotation $>$ 1 000 rpm.

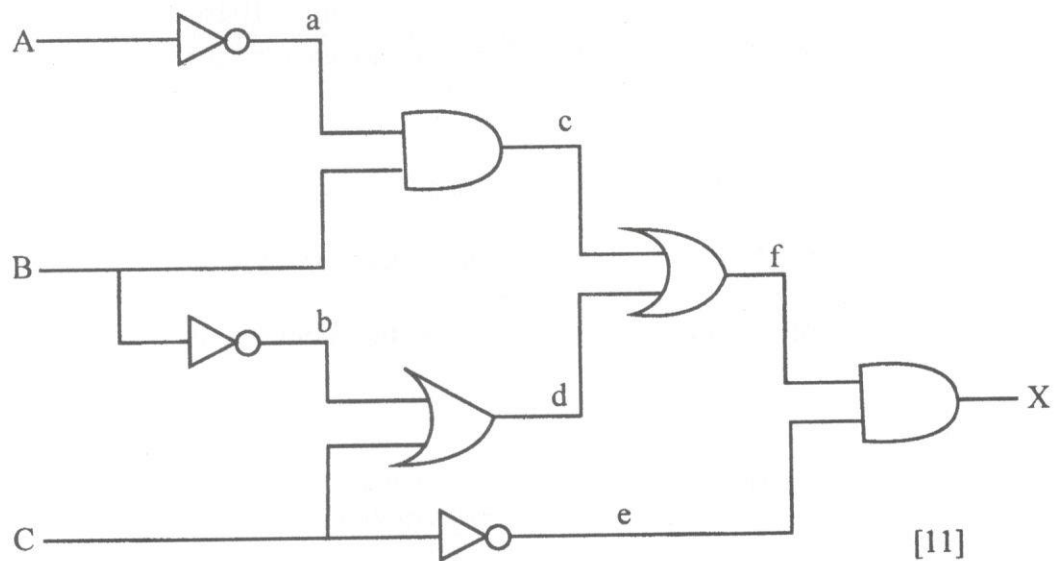
- (i) Draw a logic circuit to represent the above system. [5]
- (ii) Complete the truth table below for this system. [4]

P	T	R	workspace	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

- (b) Using a spreadsheet application program, or otherwise simulate the following logic circuit. Use only the following logic gates.

Logic Gate	Spread Sheet Formula
	= NOT (....)
	= AND (....)
	= OR (....)
	= XOR (....)

Logic circuit



Hint: Print the spreadsheet application program showing the formulas and the completed truth table with all the intermediate results.

- 2 (a) Draw a well labelled diagram showing the Main Memory, Central Processing Unit (CPU) and the following registers: Memory Address Register (MAR), Memory Data Register (MDR), Current Instruction Register (CIR) and Program Counter (PC) which illustrates the Fetch Decode-Execute Cycle.

[10]

- (b) An alarm sounds when certain conditions occur in a nuclear reactor. The output, X, of a logic circuit that drives the alarm must have a value of 1 if:

either carbon dioxide pressure is too low and temperature $\leq 300^\circ\text{C}$
or water pressure > 10 bar and temperature $> 300^\circ\text{C}$.

The inputs to the system are:

Input	Binary	Condition
P	O	carbon dioxide pressure too low
	1	carbon dioxide pressure acceptable
T	O	temperature $> 300^\circ\text{C}$
	1	temperature $\leq 300^\circ\text{C}$
W	O	water pressure > 10 bar
	1	water pressure ≤ 10 bar

- (i) Produce a logic statement for the scenario given above. [1]
- (ii) Draw the logic circuit for the alarm system. [5]
- (iii) Produce the truth table for the alarm system. [4]

Section B [50 marks]

Answer any **one** question from this section.

- 3 A student writes a program using a relaxed form of structured English. The student uses identifiers that contain illegal characters such as the arithmetic operators to name variables.

Assuming that the identifiers should have been made up of small alphabetic characters and the maximum length of each identifier is 32 characters, write functions that will validate variable names on the following basis.

- (a) (i) the length check, [5]
- (ii) whether or not it contains the illegal characters. [10]
- (b) Write code snippets that will accept an invalid identifier and perform the following tasks:
 - (i) If it is too long truncate it and discard the right most part [5]
 - (ii) It then checks if there are any illegal characters and removes them [12]

Hint: You may use the function defined in part (a) to perform checks by calling them.

- (c) Construct flowcharts for the following programming constructs:
 - (i) Nested if statement [3]
 - (ii) Sequence [2]
 - (iii) Bottom tested loop [3]
- (d) (i) Using a programming language of your choice, state any **four** statements used with random access files. Give the purpose of each statement. [8]
- (ii) Write any **two** statements which are common to both sequential and random files. [2]

- 4 (a) Write an algorithm of a program that accepts 50 numbers through the keyboard and outputs the smallest, highest and the average of all the numbers entered. [10]
- (b) Convert the above algorithm in (a) into a program. Use a text editor or IDE environment to produce the code. [11]

- (c) (i) A series of characters J, F, H, U, S, X, T are to be entered into a binary search tree in the order given.

Draw a binary search tree to show how these values will be stored. [7]

- (ii) The following data is to be in arrays Data, L and R.

Data	"J"	"F"	"H"	"U"	"S"	"X"	"T"
	[1]	[2]	[3]	[4]	[5]	[6]	[7]

L	2	0	0	5	0	0	0
	[1]	[2]	[3]	[4]	[5]	[6]	[7]

R	4	3	0	6	7	0	0
	[1]	[2]	[3]	[4]	[5]	[6]	[7]

Using the arrays above, dry run the following pseudocode by completing the trace table below it.

Item = "T"

Ptr = 1

While Data [Ptr] < > Item Do

Print Data [Ptr]

If Data [Ptr] > Item Then

Ptr = L [Ptr]

Else

Ptr = R [Ptr]

Endif

Endwhile

Print Data [Ptr]

Trace table

Item	Ptr	Printed output
"T"	1	"J"

[6]

- (d) Write a pseudocode of a program that will output the square root of any input number. The program must stop when the number input is zero (0).
- (e) Write a program code that will use a loop to create the array given below and accept its values.

[7]

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]
9	12	15	17	4	5	8	9

[9]

Section C [30 marks]

Answer any **one** question from this section.

- 5 (a) Using text editor or IDE environment, write SQL statements to perform the following;

- (i) Create a table called "Students" with the following details:

field Name	datatype	size
student ID	integer	4
surname	character	20
firstname	character	20
class	character	2
fees paid	number	4

[14]

NB: Student ID is the primary key

- (ii) Display the surname and firstname fields only of students whose class is 1A and fees paid is less than 100.

[6]

- (iii) Delete a student record whose first name is Ralph from the student's table.

[3]

- (b) Draw an ER diagram for the situation given below:

An account is a relationship between customer and a bank. A bank has a branch code. A customer may have several accounts of different types and balance.

[7]

- 6 (a) Using a text editor or IDE environment write SQL statements to perform the following:

- (i) Create a database called "schoolfees."

[1]

- (ii) Create the tables "Student Details" and "Invoice" with the following details:

[13]

Students_details

field name	data type	size
Student_name	text	30
class	text	10
address	text	50
student_ID [Primary Key]	text	5

Invoice

field name	data type	size
student_ID	text	5
fees_amount	currency	
fees_paid	currency	
invoice_number	text	5
fees_balance	currency	
due_date	date/time	

NB: student_ID is the foreign key
invoice_number is the primary key

- (iii) Create a calculated field to calculate balance fees by subtracting paid fees from fees amount using a query. The query should display all fields from the Invoice table including the new calculated field.

[6]

- (b) A database design has three tables to store the classes that students attend.

student (student ID, FirstName, LastName, Year, Tutorgroup)

class (classID, subject)

class_Group (Student ID, ClassID)

- (i) Draw a diagram to illustrate the relationship between
1. class and class_Group [1]
 2. class_Group and student [1]
- (ii) Write an SQL statement to display the studentID and FirstName of all students who are in the Tutor-group 3W. Display the list in alphabetical order of LastName. [4]
- (iii) Write an SQL statement to display the LastName of all students who attend the class whose classID is No13. [4]