

Candidate Name

Candidate Number

Centre Name

Centre Number

Paper 3: Advance Theory

For Examination December 2023

(1 hour 30 minutes)

You must answer on this question paper.

It is necessary to respond on the answer sheets provided alongside this question paper. Additionally, you must have a soft pencil (preferably of type B or HB), a clean eraser and a dark blue or black pen.

INSTRUCTIONS:

- You must write your name, candidate number, centre name and centre number on the answer sheets in the designated spaces.
- Attempt all the questions from using a dark blue or black pen.
- It is important to follow the instructions provided on the answer sheets.
- Do not use correction fluid.
- Avoid writing on any bar codes.
- Maximum Mark: 75

Q1. Floating-point representation in a computer system is utilized for storing real numbers with specific bit allocations. Consider a system with:

- 10 bits for the mantissa
- 6 bits for the exponent
- Two's complement form for both the mantissa and the exponent.

(a) Determine the normalized floating-point representation of the number **-7.25** in this system. Show your step-by-step calculations. [3]

Mantissa

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Exponent

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Your working here:

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b). Determine the decimal value of the provided binary floating-point number. Show your step-by-step calculations. [3]

Mantissa:

1	0	1	1	0	0	0	1	1	1
---	---	---	---	---	---	---	---	---	---

Exponent:

0	0	1	1	1	1
---	---	---	---	---	---

Your Working:

Answer: _____

c). The provided binary floating-point number is not normalized. Normalize the floating-point number and show your step-by-step calculations. [3]

Mantissa:

0	0	0	0	0	0	0	1	1	1
---	---	---	---	---	---	---	---	---	---

Exponent:

1	0	0	1	1	1
---	---	---	---	---	---

Mantissa:

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Exponent:

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Your Working:

d). The denary number 742 cannot be stored accurately as a normalized floating-point number in a computer system with a specific format.

(i). Explain the reason for this. [3]

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(ii). Describe an alteration to the way floating-point numbers are stored to enable this number to be stored accurately using the same total number of bits. [2]

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Q1 TOTAL: 15

Q2. (a). Explain the process by which a just-in-time compiler (JIT) executes a program without generating a complete translated version of it. [4]

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(b). The terms related to Operating Systems are mixed up in the table provided below. Choose the correct match and write at the spaces provided. [5]

Multi-tasking.	Using secondary storage to simulate additional main memory.
Paging.	Managing the processes running on the CPU.
Interrupt handling.	Managing the execution of many programs that appear to run at the same time.
Scheduling.	Locating non-contiguous blocks of data and relocating them.
Virtual memory	Transferring control to another routine when a service is required.

	Reading/writing same-size blocks of data from/to secondary storage when required.
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- i.
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- ii.
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- iii.
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- iv.
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- v.
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c). State two benefits and two drawbacks of packet switching. [4]

Benefit 1:

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Benefit 2:

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Drawback 1:

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Drawback 2:

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d). What is the relationship between an assembly language and machine code? [2]

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Q2 TOTAL: 15

Q3(a). Use the program below to answer the following questions.

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binary_input = input()
decimal_output = 0
weight_factor = 1

for binary_digit in reversed(binary_input):
    if binary_digit == '1':
        decimal_output += weight_factor
        weight_factor *= 2

print(binary_input, "=", decimal_output)
```

i. What is the purpose of the above python program? [2]

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ii. Locate all the variables in the program. [3]

Variables:

iii. How does the program convert the binary number to its decimal equivalent? [2]

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iv. Why is the reversed function used in the program? [2]

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v. What does the program print at the end of its execution? [2]

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b). In accordance with von Neumann's architectural principles, discuss the intricate stages or instruction cycle comprising the processor's cyclic execution for every instruction within a program. [6]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

c). What three factors impact the performance of a CPU? [3]

- i.
- ii.
- iii.

Q3 TOTAL: 20

Q4. The database tables – member table and member_profession table below were joined using SQL commands. Use it to answer the following questions:

+ Options

member_id	fname	PROFESSION_ID	PROFESSION_NAME
1	Alikhan	1	publicist
2	Ahmet	1	publicist
3	Mirzhakyp	1	publicist
4	Magzhan	1	publicist
5	Saken	1	publicist
6	Ilyas	1	publicist
7	Zhakhansha	1	publicist
8	Smagul	1	publicist
9	Nygmet	1	publicist
10	Shakarim	1	publicist
11	Beyimbet	1	publicist
12	Mukhtar	1	publicist
13	Sanzhar	1	publicist
14	Mustafa	1	publicist

a). Write a SQL command that uses inner join to select all member_id from member table, profession_id from member_profession table, profession_name from profession table. [4]

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b). Select all record from member and profession table where birth_place column has the value semey [3]

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b (ii). Select all fname, age, profession_name where age > 44 [3]

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c). Select all customers from the " member_profession" table, sorted ascending by the "MEMBER_ID" and descending by the "PROFESSION_ID" column. [3]

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c(ii). Select all records from the "profession" table where the PROFESSION_NAME column has the value writer. [3]

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Q4 TOTAL: 16

Q5. (a) (i) Explain why Reverse Polish Notation (RPN) is used to carry out the evaluation of expressions. [2]

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(ii) Identify, with two reasons, a data structure that could be used to evaluate an expression in RPN. [3]

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(b) Write the infix expression in RPN. [1]

$$(a - b) \times (a + c) / 7$$

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bii). Write the RPN expression as an infix expression. [1]

$$a \ b / 4 \times a \ b + -$$

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iii. Evaluate the RPN expression: $a \ b + c \ d / /$ [2]

where $a = 17$, $b = 3$, $c = 48$ and $d = 12$.

Your working:

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