Multiverse Victory Project -

MVP 2024
MULTIVERSE VICTORY PROJECT

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General Certificate of Education (Adv. Level) Examination, August 2024

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පැය තුනයි
Three hours

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Additional Reading Time - 10 Minutes

Use **additional reading time** to go through the question paper, select the questions and decide on the questions that you give priority in answering.

ITsphere

Index No: .....

Important :

- *This paper consists of **8 pages.***
- *This question paper comprises of two parts, **Part A** and **Part B.** The time allotted for **both parts** is **three hours.***
- *Use of calculators is **not allowed.***

Part A – Structured Essay:

(pages 2 – 5)

- *Answer all the questions **on this paper itself.** Write your answers in the space provided for each question. Note that the space provided is sufficient for your answer and that extensive answers are not expected.*

Part B – Essay

(pages 6 – 8)

- *This part contains **six questions**, of which, **four** are to be answered. Use the papers for this purpose.*
- *At the end of the time allotted for this paper, tie the **two parts together** so that* **Part A** *is **on top** of* **Part B** *before handing them over to the Supervisor.*
- *You are permitted to remove **only** **Part B** of the question paper from the Examination Hall.*

For Examiner's Use Only

For the Second Paper		
Part	**Question No.**	**Marks**
A	**1**	
	2	
	3	
	4	
B	**1**	
	2	
	3	
	4	
	5	
	6	
Total		

Final Marks

In Numbers	
In Words	

Code Number

Marking Examiner 1	
Marking Examiner 2	
Marks Checked by	
Supervised by	

Part A – Structured Essay

*Answer **all four** questions on this **paper itself.***

1. (a) When using signed two's complement notation, what is the decimal value of 11100000?

(b) Convert the decimal number 14.875 to binary.

(c) Add the following binary numbers

(i) 10110110

11010101

+11010110

(d) Convert 1432_8 octal number to its decimal equivalent.

2. (a) Calculate the size of memory if its address consists of 22 bits and the memory is 2-byte addressable.

(b) How many types of fragmentation occur in Operating System and describe each?

(c) What is Spooling?

3. (a) Write the subnet, broadcast address and valid host range for the following:

(i) 172.16.10.5 255.255.255.128

(ii) 172.16.10.33 255.255.255.224

(b) What is the **Network ID**, **Broadcast Address**, **First Usable IP**, or **Last Usable IP** on the subnetwork that the node 192.168.1.15/26 belongs to?

subnet mask is 255.255.255.192

4. A software development team is tasked with creating a new system for a large retail chain. The system needs to efficiently manage inventory, sales, and customer data to optimize operations and enhance customer experience. The team is considering different software development models for the development process.

i. For the initial phase of gathering requirements and planning, the team decides to use the _____ method to ensure thorough documentation and clear understanding of project scope.

ii. As the project progresses, the team anticipates the need for flexibility and adaptability due to potential changes in requirements. They opt for the _____ model to allow for iterative development and continuous feedback.

iii. To quickly build and test different interfaces and functionalities, the team plans to employ the _____ method, which emphasizes rapid prototyping and user involvement.

iv. During the development process, the team realizes the importance of fast-paced development and frequent deliverables. They decide to incorporate the _____ model to accelerate the development cycle and deliver usable software incrementally.

v. In order to integrate advanced decision-making capabilities into the system, the team considers implementing an _____ to provide automated, expert-level insights for inventory management and sales forecasting.

vi. To streamline administrative tasks and improve efficiency in managing routine office tasks such as document processing and communication, the team explores the implementation of _____.

vii. Recognizing the potential for leveraging artificial intelligence and machine learning, the team explores the possibility of integrating _____ into the system to provide personalized recommendations and optimize operations.

viii. As the project nears completion, the team focuses on generating comprehensive reports and analytics to support strategic decision-making. They decide to incorporate a _____ to gather, process, and present relevant data to management.

ix. To enhance user experience and provide seamless interaction with the system, the team considers implementing _____ that can adapt and learn from user behavior to optimize performance and usability.

x. Finally, to ensure effective coordination and communication among team members throughout the development process, the team plans to utilize _____ to facilitate collaboration, document sharing, and task management.

[Office automation systems, Smart systems, Management information systems, Smart systems, Office automation systems, Waterfall model, Agile model, Prototyping model, Rapid application development model, Expert system]

Multiverse Victory Project - 2024

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Part B

❖ *Answer any **four** questions only.*

1. (a) Why does the computer must keep several processes in main memory?

(b) What are the differences between:

i) Logical and physical address?

ii) Page table and segment table?

iii) Contiguous and non – contiguous storage allocation

iv) Segmentation and paging storage?

(c) Consider a user program of logical address of size **6** pages and page size is **4** bytes. The physical address contains **300** frames. The user program consists of **22** instructions **a, b, c, . . . u, v**. Each instruction takes **1 byte**. Assume at that time the free frames are **7, 26, 52, 20, 55, 6, 18, 21, 70,** and **90.** **Find the following:**

i) Draw the logical and physical maps and page tables?

ii) Allocate each page in the corresponding frame?

iii) Find the physical addresses for the instructions m, d, v, r?

iv) Calculate the fragmentation if exist?

2. Consider the following scenario.

A small startup is aiming to develop a mobile application that connects users with local volunteer opportunities in their community. The app will allow users to browse through various volunteer opportunities, sign up for events, track their volunteer hours, and receive updates on upcoming events. The startup is in the initial planning stages and is considering different software development models for the project.

i. What are the key features and functionalities that the startup aims to incorporate into the volunteer opportunity mobile application?
ii. What are the primary goals and objectives of the startup in developing this application, both from a business perspective and a social impact perspective?
iii. How does the startup plan to engage and attract users to the mobile application, considering the competitive landscape and the target audience's preferences?

iv. What are the potential challenges and obstacles that the startup might face during the development process, particularly in relation to integrating various volunteer opportunities and ensuring user engagement?

v. How does the startup plan to prioritize and manage the development tasks and milestones to ensure timely delivery of the mobile application to the market?

vi. What criteria will the startup use to evaluate and select the most suitable software development model for this project, considering factors such as time-to-market, flexibility, and scalability?

vii. How does the startup plan to gather feedback and iterate on the mobile application after its initial release to continuously improve the user experience and meet evolving user needs and preferences?

3. Consider the following problem.

A student needs to design a logic circuit to model the requirements for membership of a **snooker club.**

Membership (X) depends on four criteria, as shown in the table:

Parameter	Description of parameter	Binary value	Condition
A	Over 18	1	True
		0	False
B	Recommended	1	True
		0	False
C	Full-time	1	True
		0	False
D	Retired	1	True
		0	False

Membership is approved (X = 1) if the person:

- is over the age of 18 **and** has been recommended by a pre-existing member **and**
- **either** is working full-time **or** is retired, **but not both**

(a) Draw the logic circuit and truth table to show all the possible situations when the output X could be received.

(b) Obtain the Boolean expression from the truth table and simplify it using Boolean algebraic laws. (Show all the **laws and theorems** used.)

(c) Draw a logic circuit for the simplified Boolean expression using **only NAND** gates.

(d) Simplify the following Boolean functions, using four-variable maps:

(i) $F(w, x, y, z) = \sum (1, 4, 5, 6, 12, 14, 15)$

(ii) $F(A, B, C, D) = \sum (0, 1, 2, 4, 5, 7, 11, 15)$

4. Consider the following flat file database table.

ID	Title	First name	Surname	Address	City	Postcode	Telephone
1	Mr	Tom	Smith	42 Mill Street	London	WE13GW	010344044
2	Mrs	Sandra	Jones	10 Low Lane	Hull	HU237HJ	022344033
2	Mr	John	Jones	10 Low Lane	Hull	HU237HJ	022344033

(a) Covert the above table into 2nd normal form and 3rd normal form.

(b) Write down the functional dependencies of each normalized table.

(c) Describe the following terms:

i) Deletion Anomaly

ii) Update Anomaly

iii) Data integrity

5. Perform the following calculations.

A shop sells books, maps and magazines. Each item is identified by a unique 4-digit code. All books have a code starting with 1, all maps have a code starting with 2 and all magazines have a code starting with 3. The code 9999 is used to end the algorithm.

(a) Draw a flowchart which inputs the codes for all items in stock and outputs the number of books, number of maps and the number of magazines in stock. Include any validation checks needed.

(b) Write the pseudocode for the above flowchart.

(c) Write a Python program using function definition.

6. The Acme Company would like to subnet its network (195.5.5.0) so that there are 50 separate subnets. They will need only 2 hosts in each subnet.

a) Complete each of the following:

The subnet mask, addresses for the first few subnets, and the total number of subnets created.

* Copy down the following table.

Subnet	Network address	Host addresses	Broadcast address
Subnet mask: 255.255.255.___			
First subnet	195.5.5.___	195.5.5.___ - 195.5.5.___	195.5.5.___
Second subnet	195.5.5.___	195.5.5.___ - 195.5.5.___	195.5.5.___
Third subnet	195.5.5.___	195.5.5.___ - 195.5.5.___	195.5.5.___
Fourth subnet	195.5.5.___	195.5.5.___ - 195.5.5.___	195.5.5.___
Fifth subnet	195.5.5.___	195.5.5.___ - 195.5.5.___	195.5.5.___
Sixth subnet	195.5.5.___	195.5.5.___ - 195.5.5.___	195.5.5.___
Seventh subnet	195.5.5.___	195.5.5.___ - 195.5.5.___	195.5.5.___
.			
.			

b) As part of an advanced networking exercise, students are tasked with subnetting the Acme Company's network (195.5.5.0) to accommodate 50 separate subnets, each with only 2 hosts. For the initial phase, students are required to design a network diagram illustrating the first 5 subnets. The diagram should include a central router connecting to multiple switches, with each switch representing a subnet. Within each subnet, two host devices should be depicted, along with appropriate labeling and distinction for clarity. Additionally, students should include a central server in the main network for shared resources and services, along with an internet gateway for external connectivity. Optional components such as firewalls for network security may also be included. The

diagram should adhere to networking standards and conventions, ensuring clear organization and understanding.

a) What if Acme Company experiences rapid growth and needs to expand its network to accommodate additional subnets beyond the initial 50? How would you modify the existing network infrastructure to support this expansion while ensuring efficient management and scalability?

b) What if one of the host devices in Subnet 3 experiences a hardware failure? How would this impact network communication within Subnet 3, and what steps would you take to troubleshoot and resolve the issue while minimizing downtime for other network users?