THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

136/1 **COMPUTER SCIENCE 1**

(For Both School and Private Candidates)

Time : 3 Hours **ANSWERS** **Year : 2023**

Instructions

1. This paper consists of sections A and B with a total of **thirteen (13)** questions.
2. Answer **all** questions in section A and **two (2)** questions from section B.
3. Section **A** carries **sixty (60)** marks and section **B** carries **forty (40)** marks.
4. Communication devices and any unauthorised materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

1. (a) The use of hierarchy memory technologies is a cost effective technique for designing large computer systems. It includes six general classes of storage media; (i) What are the six general classes of storage media made up a memory hierarchy? (ii) Arrange the classes of storage media provided in 1 (a) (i) in a Typical Storage Hierarchy Ladder Diagram. (b) Describe the two types of the memory located at the top of the hierarchy.

The six general classes of storage media in a memory hierarchy are registers, cache memory, main memory (RAM), magnetic disk, optical storage (such as CD/DVD), and magnetic tapes. These classes are arranged in terms of speed, cost, and storage capacity.

In the typical storage hierarchy ladder diagram, registers are at the top, followed by cache memory, then main memory, then magnetic disks, optical storage, and finally magnetic tapes at the bottom. This arrangement shows that as you go down, storage capacity increases but access speed decreases.

The two types of memory located at the top of the hierarchy are registers and cache memory. Registers are high-speed small storage units inside the CPU used to store data and instructions being executed. Cache memory is a high-speed storage located between the CPU and main memory used to store frequently accessed data and instructions to speed up processing.

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2. ABC Company Ltd wants to install an electric fence system to its customers. One of its logical circuits is derived from the Boolean expression $X = AB + ABC + \overline{A} + \overline{A}$. (a) Use Boolean laws of algebra to simplify the given Boolean expression. (b) Draw the logic gate circuit for the simplified Boolean expression in 2 (a). (c) Use a truth table to determine what input conditions produce logic 1 output in the logic gate drawn in 2 (b).

The given expression is $X = AB + ABC + \overline{A} + \overline{A}$. Since $\overline{A} + \overline{A} = \overline{A}$, the expression reduces to $X = AB + ABC + \overline{A}$. Using the absorption law, $AB + ABC = AB$. Therefore, $X = AB + \overline{A}$. By the covering law, this simplifies to $X = \overline{A} + B$.

The logic gate circuit for $X = \overline{A} + B$ consists of a NOT gate that inverts A, followed by an OR gate that combines $\overline{A}$ and B.

The truth table is:

A	B	$\bar{A}$	$\bar{A} + B$
0	0	1	1
0	1	1	1
1	0	0	0
1	1	0	1

Thus, the output is logic 1 when A = 0 or B = 1.

3. (a) Programs allocate memory to variables statically or dynamically depending on the programmers' requirement; (i) What does the variable mean? (ii) What is the difference between dynamic and static memory allocation? Give one circumstance in which you would prefer one instead of the other. (b) You are given the following set of integers 53, 45, 30, 67, 20, 55, 60. Design a program that would read and display them in an ascending order.

A variable is a named storage location in memory that holds data which can change during program execution.

In static memory allocation, the size and location of memory for a variable is determined at compile time, while in dynamic memory allocation, memory is assigned during program execution based on current needs. Static allocation is preferred when the amount of memory required is known beforehand, while dynamic allocation is used when memory needs vary, such as when handling arrays with unknown sizes.

A simple program to display integers in ascending order:

```
#include <iostream>
```

```
using namespace std;

int main() {

   int arr[7] = {53, 45, 30, 67, 20, 55, 60};

   int n = 7, temp;

   for(int i = 0; i < n-1; i++) {

      for(int j = i+1; j < n; j++) {

         if(arr[i] > arr[j]) {

            temp = arr[i];

            arr[i] = arr[j];

            arr[j] = temp;

         }

      }

   }

   cout << "Numbers in ascending order: ";

   for(int i = 0; i < n; i++) {

      cout << arr[i] << " ";

   }

   return 0;
```

```
}
```

This program sorts the numbers 20, 30, 45, 53, 55, 60, 67.

4. Umoja Secondary School introduced an awareness campaign for optimal use of its electricity to the community members. In that campaign, you decided to develop a site that will provide awareness of switching ON and OFF the light in classrooms appropriately. Write HTML embedded with JavaScript codes that will help you to display the webpage in Figure 1.

```
<!DOCTYPE html>

<html>

<head>

<title>Electricity Awareness</title>

</head>

<body style="background-color:lavender; text-align:center;">

  <h1>Electricity Awareness Campaign</h1>

  <p>Switch off the light when not in use.</p>

  <p style="color:blue;">Save energy for future generations.</p>

  <img id="bulb" src="bulb_off.png" width="90" height="170">

  <br><br>

  <button onclick="document.getElementById('bulb').src='bulb_on.png'">Turn ON</button>

  <button onclick="document.getElementById('bulb').src='bulb_off.png'">Turn OFF</button>
```

</body>

</html>

This webpage uses Lavender background, a level 1 heading, blue text in the third sentence, and JavaScript to switch the bulb image ON and OFF when buttons are pressed.

5. (a) Assume that Form1 in Visual Basic is a custom dialog box. What are the activities of the following statements?

   (i) Form1.Show

   (ii) Form1.Hide

   (b) Tanzania Railway Cooperation (TRC) needs to validate the date of travel for the reservation facility. The booking should either be on the current day or the next 15 days. How would you implement this using Visual Basic?

   (c) The following table shows ages of members and activities available in a Bonanza. Use the information in the table to write a Visual Basic program that accepts the age of a member through a text box. The program should then display the activity on a message box.

The statement Form1.Show displays the custom dialog box Form1 on the screen, making it visible to the user. The statement Form1.Hide hides the dialog box Form1 from the screen without closing or unloading it, meaning it can be shown again later.

To validate the date of travel in Visual Basic, you can use DateTime functions to compare the entered date with the system date. If the entered date is less than today or greater than today + 15 days, display an error message; otherwise, accept the date.

Example:

```
If travelDate < Date.Today Or travelDate > Date.Today.AddDays(15) Then
```

```
    MsgBox("Invalid date. Booking must be today or within the next 15 days.")
Else
    MsgBox("Booking accepted.")
End If
```

For the Bonanza program:

```
Dim age As Integer
age = Val(TextBox1.Text)
If age >= 51 Then
    MsgBox("Charting")
ElseIf age >= 31 Then
    MsgBox("Swimming")
ElseIf age >= 16 Then
    MsgBox("Playing volleyball")
Else
    MsgBox("Dancing")
End If
```

This program takes the age input from a text box and displays the corresponding activity based on the given table.

6. (a) The rapid growth in the use of Information and Communication Technology in the society has attracted tremendous attack of the government and organizations unauthorized data via internet. Explain two principles that can be applied to avoid cyber-attack. (b) Emma Sugar Company (ESC) utilizes computerized system to operate its day to day activities. Recently, the company's manager claims to have lost employee details and therefore found it difficult to pay them timely; (i) What are the two possible causes of the data loss? (ii) Suggest two control measures you would take to avoid future loss of the data.

One principle to avoid cyber-attack is the principle of least privilege. This means giving users only the minimum access rights they need to perform their job, which reduces the chances of unauthorized users exploiting sensitive data.

Another principle is regular system updates and patch management. Ensuring that operating systems, applications, and antivirus software are updated protects the system from vulnerabilities that attackers might exploit.

Two possible causes of the data loss at ESC could be hardware failure such as a crashed hard disk or human error like accidental deletion of files. Another possible cause is malware infection, which can corrupt or destroy stored employee records.

Two control measures that could be taken are establishing a proper backup strategy, such as keeping copies of data on external drives or cloud storage, and using access controls with authentication systems to restrict unauthorized users. These measures ensure data is not only safe but also recoverable in case of loss.

7. Makole district hospital employees are facing a challenge of slowness in updating and retrieving of the information from their computers connected in a network. After detailed investigation, you realized that the network topology used produces much traffic as users connecting to the network increases. Suppose you are requested to redesign the network so as to improve the performance of the system; (a) What type of network topology was used in the hospital computer network? (b) Outline four factors you will consider before proposing a new network topology to the hospital management. (c) Which type of network topology will you suggest to design in order to replace the current network? Give a reason. (d) What are the four communication devices will be required to setup a new network topology?

The type of network topology that was used is bus topology, because it is prone to congestion and slowness as more users join the network.

Four factors to consider before proposing a new network topology include the number of users and devices expected to connect, the cost of implementation and maintenance, the performance requirements such as speed and reliability, and the possibility for future expansion or scalability.

The suggested replacement topology is star topology, because each device connects directly to a central hub or switch. This reduces traffic problems since communication is handled through the central device and failures in one cable do not affect the rest of the network.

Four communication devices required include switches or hubs to interconnect computers, routers to connect the network with external networks like the internet, network interface cards (NICs) installed in each computer, and cables or wireless access points to link devices physically or wirelessly.

8. A computer science student was assigned to create a program to help his teacher to produce annual students' reports. However, he was advised to use low and high levels of programming languages. Why was the student advised to use both programming languages? Give three points for each.

The student was advised to use low-level programming languages because they provide more direct access to hardware resources. They make programs run faster since they are closer to machine code. They also allow efficient use of memory and CPU instructions, which is necessary in performance-critical applications.

High-level programming languages were also recommended because they are easier to learn and write. They use human-readable syntax that makes programs more understandable. They also have libraries and built-in functions that reduce development time, and programs written in high-level languages are more portable across different hardware platforms.

9. The school librarian thought of having an electronic system to manage book borrowing process. If you were asked to collect information required to design this system, how would you carry out your task? Elaborate your answer by giving four points.

The first task would be to conduct interviews with the librarian and library staff to understand the current manual process and identify requirements for the new system.

The second task would be to distribute questionnaires to students and teachers to gather their opinions on features that would be useful in a book borrowing system.

The third task would be to observe the daily library operations directly. This would help to identify areas where time is wasted or errors occur so that the system can address them.

The fourth task would be to review existing records, such as borrowing registers and book catalogues. This helps in determining what data should be included in the new system such as book IDs, borrower details, borrowing dates, and return dates.

10. Analyze three opportunities and three challenges brought by IT in the work place.

One opportunity is increased efficiency, because IT allows automation of routine tasks and faster data processing, which saves time.

Another opportunity is improved communication, as IT tools like emails, video conferencing, and instant messaging allow quick sharing of information across departments and with external partners.

A third opportunity is easier access to information, because digital databases and online resources provide employees with up-to-date information needed for decision making.

One challenge is the high cost of implementation and maintenance of IT systems, which includes buying hardware, software, and training staff.

Another challenge is cyber security threats, such as hacking or viruses, which can disrupt operations and compromise sensitive data.

A third challenge is job displacement, because automation may replace roles previously done by humans, leading to job loss or the need for retraining.