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: 2013**

Instructions:

1. this paper consists of section A and B with total of ten questions
2. Answer all questions in Section A and two questions in section B
3. Use a blue or black pen.

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1. (a) Differentiate Computer hardware from Computer software; give two examples for each component of computer system.

Computer hardware refers to the tangible, physical components of a computer system that you can see and touch. These components are responsible for executing tasks and processing information. Examples include:
i. Central Processing Unit (CPU): Often termed the "brain" of the computer, the CPU performs calculations and executes instructions to operate programs. ii. Hard Disk Drive (HDD): A storage device that holds the computer's data, software, and operating system.

Computer software, on the other hand, consists of the intangible set of instructions or programs that tell the hardware what to do. Software enables users to interact with the hardware to perform specific tasks. Examples include:
i. Operating System (OS): System software like Windows, macOS, or Linux that manages hardware resources and provides services for application software.
ii. Web Browser: Application software such as Google Chrome or Mozilla Firefox that allows users to access and navigate the internet.

(b) By giving examples, describe the concept of computer memory.

Computer memory is a critical component that temporarily stores data and instructions that the CPU needs to access quickly. It plays a vital role in a computer's performance, enabling efficient data retrieval and processing. There are two primary types of computer memory:
i. Random Access Memory (RAM): A type of volatile memory that temporarily holds data and instructions that the CPU is currently processing. For instance, when you open a document to edit, it is loaded into RAM for quick access. However, all data in RAM is lost when the computer is turned off. ii. Read-Only Memory (ROM): A type of non-volatile memory that permanently stores critical data required for the computer's basic functions, such as the firmware that initiates the boot process. Unlike RAM, the data in ROM remains intact even when the computer is powered down.

2. (a) State two reasons why a computer system failure might occur.

Computer system failures can arise from various issues, including:
i. Hardware Malfunction: Failures in physical components, such as a defective power supply, overheating CPU, or failing hard drive, can lead to system crashes or prevent the computer from booting. ii. Software Corruption or Incompatibility: Corrupted system files, malware infections, or conflicts between software applications can cause the operating system or programs to malfunction, leading to system instability or failure.

(b) Mention two ways of recovering a file that has been lost or corrupted.

To recover lost or corrupted files, consider the following methods:

i. Restore from Backup: If regular backups have been maintained, you can restore the lost or corrupted file from the backup source, such as an external hard drive or cloud storage.
ii. Use Data Recovery Software: There are specialized programs designed to recover deleted or corrupted files by scanning the storage medium for retrievable data. Examples include Recuva, EaseUS Data Recovery Wizard, and Disk Drill.

(c) (i) State four reasons why do Windows programs stop responding.

Windows programs may become unresponsive due to:
i. Insufficient System Resources: Limited CPU power or inadequate RAM can cause programs to hang, especially when running resource-intensive applications simultaneously. ii. Software Conflicts: Incompatibilities or conflicts between concurrently running applications can lead to one or more programs becoming unresponsive.
iii. Corrupted Program Files: If essential files of a program are corrupted or missing, the application may fail to respond during operation. iv. Hardware Issues: Problems such as a failing hard drive, defective RAM, or overheating components can cause system instability, leading programs to stop responding.

(ii) What should be done to solve the problem in part 2(c)(i) above?

To address unresponsive Windows programs:
i. Close Unnecessary Applications: Free up system resources by closing programs that are not in use, reducing the load on the CPU and RAM. ii. Update or Reinstall Software: Ensure that all applications are up-to-date. If a program continues to be unresponsive, consider reinstalling it to replace any corrupted files.
iii. Check for Hardware Issues: Run hardware diagnostics to identify and resolve problems with components like RAM or the hard drive. Replacing faulty hardware can restore system stability. iv. Scan for Malware: Use reputable antivirus software to check for and remove any malware that could be causing system instability.

3. The cost of an international call from Tanzania to Uganda is calculated in Tshs as follows: Connection fee 199/=; 200/= per minute is charged for the first three minutes; and 45/= for each additional minute. Design an algorithm that asks the user to enter the number of minutes the call lasted. The algorithm then uses the number of minutes to calculate the amount due.
Algorithm:
i. Start ii. Input: Prompt the user to enter the total duration of the call in minutes (let's denote this as N).
iii. Initialize: Set the total_cost to the connection fee, which is 199 Tshs. iv. Calculate Cost:
- If $N \leq 3$:
- total_cost = total_cost + (N x 200) - Else:
- total_cost = total_cost + (3 x 200) + ((N - 3) x 45) v. Output: Display the total_cost to the user.
vi. End

4. (a) Explain the importance of using a compiler rather than an interpreter to execute a piece of high-level language code.

A compiler translates the entire high-level program into machine code before execution, ensuring faster runtime. It also detects syntax errors before the program is run. This makes compiled programs efficient and suitable for production environments. An interpreter, on the other hand, translates and executes code line-by-line, which slows down the execution and is more suitable for debugging.

4. (b) What will be printed by the following program if the input is 20 and 15? Program:

```
#include <iostream> using
namespace std; const int
NUM = 10; const double
x = 20.5;
int main ()
{     int a, b;
double z;
char grade;
a = 25;
   cout << "a=" << a << endl;
cout << "Enter two integers:";
cin >> a >> b;     cout << endl;
   cout << "The numbers you entered are " << a << " and " << b << endl;
z = x + 2 * a - b;     cout << "z = " << z << endl;
   grade = 'A';
   cout << "Your grade is " << grade << endl;
a = 2 * NUM + z;
   cout << "The value of a = " << a << endl;
   system("PAUSE");
   return 0;
}
```

Solution:
Given inputs: a = 20, b = 15 Step-by-step
execution:
i. `a = 25` (initial value of `a` before user input).
ii. The program prompts for two integers. User enters `a = 20` and `b = 15`.
iii. Calculation of `z`:
  z = x + 2 * a - b
  = 20.5 + 2 * 20 - 15
  = 20.5 + 40 - 15
  = 45.5

iv. Assignment of `a` to `2 * NUM + z`: a
= 2 * NUM + z
  = 2 * 10 + 45.5
  = 20 + 45.5
  = 65.5
Output: a
= 25
Enter two integers:
The numbers you entered are 20 and 15
z = 45.5 Your grade is A
The value of a = 65.5

5. A company has introduced a new computer system in its headquarters building and regional offices. Each of the offices has a network of computers. The individual networks are joined together to allow communication within the building and between the headquarters and regional offices. Explain the purpose of the following network components and how they can be used in the company's offices.

(a) Bridges
Bridges are used to connect and filter traffic between two or more network segments. They operate at the data link layer of the OSI model and help reduce network congestion by dividing a large network into smaller segments. In the company's offices, bridges can connect different departmental networks within the same building to ensure efficient communication while minimizing unnecessary data traffic.

(b) Routers
Routers are devices that connect different networks and direct data packets between them. They operate at the network layer of the OSI model and determine the best path for data to travel between networks. In the company's offices, routers can link the headquarters network with the regional office networks, enabling seamless communication and data exchange between the locations.

(c) Modems
Modems (modulator-demodulator) are devices that convert digital signals from a computer into analog signals for transmission over telephone lines and vice versa. They are typically used for internet access. In the company's offices, modems can provide internet connectivity, enabling employees to access online resources and communicate externally.

6. A bookshop contains a number of books. Each book is about a single subject. There may be more than one book for each subject. A book may have more than one author and each author may have written more than one book.
Draw an entity relationship (E-R) diagram to represent this data model in third normal form and label the relationships.

Solution:

Entities:
- Book (Book_ID, Title)
- Author (Author_ID, Name)
- Subject (Subject_ID, Subject_Name)

Relationships:
- Book is about one Subject (1:N relationship between Book and Subject).
- Author writes one or more Books, and each Book has one or more Authors (M:N relationship between Book and Author).

The E-R diagram can include:
- Entity "Book" with attributes Book_ID and Title.
- Entity "Author" with attributes Author_ID and Name.
- Entity "Subject" with attributes Subject_ID and Subject_Name.
- Relationships labeled as "is about" and "writes".

7. (a) What is the purpose of the following Visual Basic file types?
(i) .vb
The .vb file extension is used for Visual Basic source code files. These files contain the code written in Visual Basic, including the definitions of classes, modules, and functions.
(ii) .frm
The .frm file extension is used for Visual Basic form files. These files store the design of the graphical user interface (GUI), including layout and controls such as buttons and text boxes.

(b) Explain the purpose of Name and Caption properties of menu items as used in Visual Basic project.
i. The Name property is used to identify a menu item within the code. It is a unique identifier that programmers use to refer to the menu item when writing event-handling code. ii. The Caption property specifies the text that is displayed on the menu item in the application's user interface. It provides a user-friendly label for the menu item.

(c) Differentiate an option button from a check box control as used in Visual Basic project.
i. An option button (also known as a radio button) allows the user to select only one option from a group of mutually exclusive choices. Selecting one option automatically deselects any previously selected option. ii. A check box allows the user to select or deselect one or more independent options. Each check box operates independently, so multiple check boxes can be selected simultaneously.

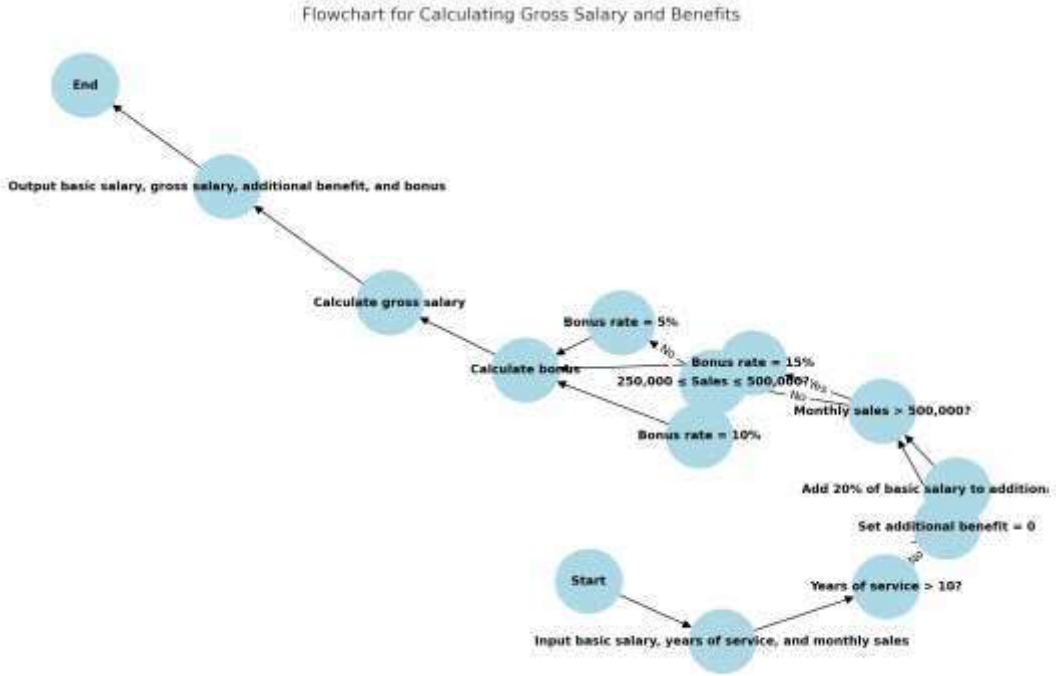
8. The gross salary of employees in Musoma fisheries company is based on basic salary and additional benefit as follows:
(a) Employees who have worked for the company for more than 10 years receive an additional payment of 20% of their basic salary.
(b) Monthly salary bonus based on monthly sales of fish is as follows:

Monthly Sales	Bonus Rate (%)

Above 500000	15
Between 250000 and 500000	10
Below 250000	5

Draw flowchart for a program that would be used to calculate the gross salary and then output each employee's basic salary, gross salary and all benefits.

Solution: Flowchart:
i. Start ii. Input: Basic salary, years of service, and monthly sales.
iii. Check if years of service > 10:
- If yes, calculate additional benefit = 20% of basic salary.
- If no, additional benefit = 0. iv. Check sales range:
- If sales > 500000, bonus rate = 15%.
- If sales between 250000 and 500000, bonus rate = 10%.
- If sales < 250000, bonus rate = 5%.
v. Calculate bonus = (bonus rate / 100) × basic salary.
vi. Calculate gross salary = basic salary + additional benefit + bonus. vii. Output: Basic salary, gross salary, additional benefit, and bonus. viii. End



9. (a) Write HTML codes to display the information as shown below:

State territory:

RWA
TZT
KEN
UGA
KON
BUR
RWA

```
<!DOCTYPE html>
<html>
<head>
   <title>State Territory</title>
</head>
<body>
   <label for="state">State territory:</label>
   <select id="state" name="state">
      <option value="RWA">RWA</option>
      <option value="TZT">TZT</option>
      <option value="KEN">KEN</option>
      <option value="UGA">UGA</option>
      <option value="KON">KON</option>
      <option value="BUR">BUR</option>
   </select>
</body>
</html>
```

(b) Explain how .jpg can increase the speed of page loading of web pages?

The .jpg file format is optimized for web use, and it helps increase page loading speed because:
i. It is a compressed image format that reduces file size without significant loss of quality. This allows web pages to load faster since smaller files are transmitted more quickly over the internet.
ii. It supports variable compression levels, enabling web developers to strike a balance between image quality and file size for faster loading.

10. (a) Use Boolean laws of algebra to simplify the following Boolean expression: Z = $(A + \overline{B} + \overline{C})(A + \overline{B}\,C)$

Solution:
Apply the Distributive Law:
$Z = A + \overline{B} + \overline{C} + \overline{B}\,C$ Combine terms:
$Z = A + \overline{B} + \overline{C}$

(b) Draw a logic gate circuit from the Boolean expression function given below: $\overline{A}$ $\overline{B} + \overline{C}\ (A + B)$

Solution:

11. Describe six characteristics of comprehensive system documentation.

Solution:

Comprehensive system documentation refers to detailed records about a system's design, development, and operation. The six characteristics include:

i. Completeness: The documentation should cover all aspects of the system, including hardware, software, and processes, leaving no gaps. ii. Accuracy: It must provide precise and correct information, reflecting the system's actual implementation and usage.

iii. Clarity: The language and structure should be easy to understand, ensuring that all stakeholders can use it effectively.

iv. Organization: The documentation should be well-structured and logically organized, making it easy to locate specific information.

v. Maintainability: It should be designed for easy updates, allowing modifications to reflect changes in the system.

vi. Accessibility: It must be readily available to authorized users, ensuring they can access it when needed for troubleshooting or training.

12. Describe five components that must come together to produce a Computer-Based Information system.

Solution:

A Computer-Based Information System (CBIS) is a system that integrates technology, people, and processes to collect, store, and process data into meaningful information. The five components are:

i. Hardware: Includes physical devices such as computers, servers, and network equipment that provide the infrastructure for data processing and storage.

ii. Software: Refers to the programs and applications that run on the hardware, enabling users to perform specific tasks, such as data analysis or transaction processing. iii. Data: The raw facts and figures that are processed to produce meaningful information, serving as the system's foundation.

iv. People: Users and IT professionals who design, implement, and maintain the system, ensuring it meets organizational needs.

v. Processes: The procedures and rules that govern how data is collected, processed, and stored to achieve the system's objectives.

13. Explain two positive and three negative impacts of Information Technology (IT) on environmental sustainability.

Solution: Positive

Impacts:

i. Reduction in Paper Usage: IT has enabled digital communication and document storage, reducing the reliance on paper and thereby saving trees and conserving forests. ii. Energy Efficiency: Advanced IT systems, such as smart grids and energy-efficient hardware, help reduce energy consumption, contributing to sustainability.

Negative Impacts:
i. E-Waste: The rapid obsolescence of IT devices results in significant amounts of electronic waste, which can harm the environment if not properly recycled. ii. Energy Consumption: Data centers and IT equipment require substantial energy, contributing to carbon emissions and global warming.
iii. Resource Depletion: The production of IT hardware consumes finite natural resources, such as rare earth metals, leading to resource scarcity.