00506

Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Final Examination
Year 1, Semester 1 (2022)

IT1020 – Introduction to Computer Systems

Duration: 2 Hours

December, 2022

Instructions to Candidates:

- Students will be given 10 minutes additional reading time.
- This paper has 2 sections and 4 questions.
- Answer all questions in the booklet given.
- The total marks for the paper is 100.
- This paper contains 6 pages, including the cover page.
- Electronic devices capable of storing and retrieving text, including calculators and mobile phones are not allowed.

Section 1- Computer Fundamental

Question 1 **(25 marks)**

a) The evolution of computer technology can be divided into five generations. **Hard-Wired Programming** is used in **first generation** to give instructions to the computer.

i. Briefly explain what **Hard-Wired Programming** is (2 marks)

ii. Identify the **disadvantage** of Hard-Wired Programming. (2 marks)

b) Using a diagram briefly explain the memory hierarchy of a computer. (6 marks)

c) In a system which **even parity** method uses with 7-bit ASCII data and the **most significant bit** is used for parity. If the **letter V** be transmitted, is the binary word correct? Construct your answer by providing reasons. *(Note: ASCII representation of A is 65)*

(4 marks)

d) Write short notes on the following. *(Note: Include at least two points for each)*

i. Accumulator

ii. Address Bus

iii. Instruction Pointer

(6 marks)

e) Suppose that there are some instructions that are loaded in memory as follows.

Memory address	**Instruction**
350	1942
351	2945
352	5947
353	1950
354	3951
355	4952

The instructions are executed sequentially, and the current Program Counter (PC) register value is set as 351, write the content of the PC and Instruction Register (IR) values at each step of execution. (5 marks)

Question 2 (25 marks)

a) What is the main difference between combinational and sequential logic circuits? (2 marks)

b) A digital circuit is required to function with four inputs (D3, D2, D1, D0) and generate one output (A). The output A is one when there are at **least three consecutive 1's or 0's in the word** D3, D2, D1, D0 (for example 1110), output is zero otherwise.

i. Write the truth table to express the input-output behavior of the circuit. (3 marks)

ii. Write the Boolean function (F) of the circuit as a Sum-of- Product. (3 marks)

iii. Write the simplified Boolean function (Fsim) of the circuit as a SoP after simplifying it using a K-map. (3 marks)

iv. Draw the circuit diagram to implement the above circuit using basic logic gates. (3 marks)

c) The content of a characteristic table is given below.

A	B	Action
1	1	Q=1, Q'=0
1	0	Q=0, Q'=1
0	1	Latch
0	0	Latch

i. Name the circuit that is represented by this characteristic table. (2 marks)

ii. Draw the circuit diagram for this characteristic table. *(Note: Name the input A and B appropriately)* (4 marks)

d) "**Operating system is a good resource allocator**".
Discuss this statement. Your discussion must include what resources the operating system allocates, to whom the resources are allocated and why the resources are allocated. (2 marks)

e) What is a **multiprogramming** system? Briefly explain how multiprogramming **increases** the performance of the computer. (3 marks)

Section 2- Network Fundamental

Question 3 **(25 marks)**

a) A local area network (LAN) is a network which connects network devices over a relatively small geographical area.

i. List down two network devices which can be used to create a LAN. (4 marks)

ii. What is the device required to connect two LANs together? (2 marks)

iii. Write down an example for each of the network elements

1. End Device
2. Intermediate Networking Device
3. Transmission Medium

(3 Marks)

b) ISO OSI Reference model describes how information from a software application in one computer moves through the network the software application in another computer.

i. Mention which OSI layer is responsible for the given tasks. (Write the layer name, **not** the number).

1. Identify the source and destination processes for communication
2. Responsible for maintaining a logical address that can facilitate device to device communication
3. Add security to data by encrypting communication between two applications
4. Successfully transmit the data to the next hop (nearest connected device)
5. Provides an interface for the user to access network features such as web browsing, file sharing and email.

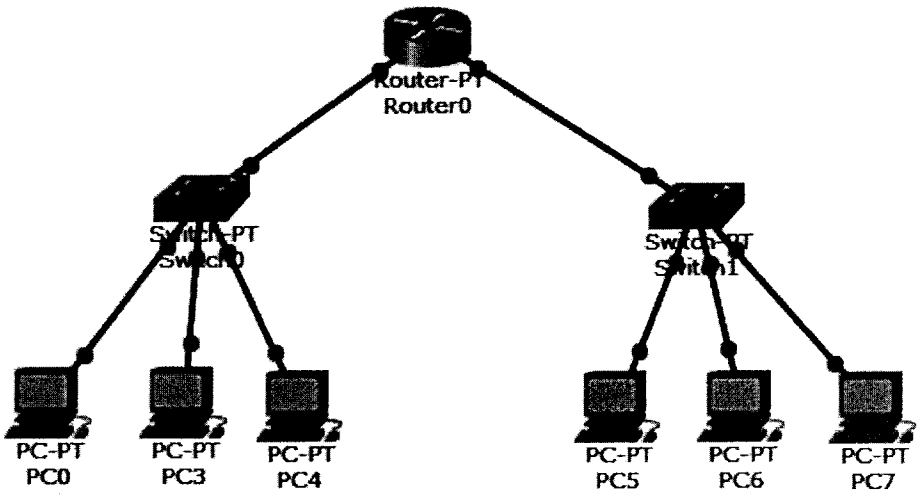
(10 Marks)

ii. Which addresses are used in the layers given below? (6 Marks)

1. Transport Layer
2. Network Layer
3. Datalink Layer

Question 4 (25 marks)

a) Refer the diagram given below and answer the questions.



i. How many broadcast domains exist in this network?

(3 Marks)

ii. How many collision domains exist in this network?

(3 Marks)

iii. How many Local Area Networks (LAN) exist in this network?

(2 Marks)

iv. In the diagram above PCs are connected to the switches using Unshielded Twisted Pair (UTP) ethernet cables.

1. What is the connector type used for the cables mentioned above?

(1 Mark)

2. Mention two factors that may affect the quality of the signal carried using the cable type above.

(2marks)

b) John's office PC IP address is 192.168.20.13 and he is interested in knowing more details regarding his network configuration.

i. Based on the given IP address, find the following values.

1. What is the network address of John's office network?
2. What is the class of the above network?
3. What is the subnet mask Jhon's PC is using?
4. Which address can be used by anyone in John's network to send messages to every other device in the same network?
5. What is the maximum number of PCs that can be connected to this network?

(10marks)

c) John is also concerned about the security of his PC and the network. Identify the attack type based on the given description below.

i. A server in John's office network is receiving unusual number of requests and now it is impossible for legitimate users to use the server.

ii. Someone pretending to be IT support division is calling John to ask for his PC password.

(4 Marks)

*** End of Paper ***