

Information and Communication Technology (Paper No 20)**Paper II – B****Marks Allocated 15 x 4 = 60****A -75, B – 65, C-55, S – 35****a) Three components**

- ALU
- CU
- Registers

[0.5 Marks * 3 = 1.5 Marks]**ALU**

- Performs mathematical calculations.
- Perform comparisons of data.

CU

- Performs all the functions of a computer system.
- Decodes instructions in the memory.
- Sends signals to the relevant components.

Registers

- Temporarily store data and instructions until they are sent to the ALU.
- Stores processed data (results) until sends to the main memory (storage device)

[For any answer from each category 0.5 Marks * 3 = 1.5 Marks]**b) Storage compaction is needed to bring all used storage to one end of the storage in order to claim unused/usable storage space for efficient use.****[0.5 Marks * 4 = 2 Marks]**

c) File size = 10,400 bits = 1,300 bytes

Size of a cluster = 512 bytes.

Therefore number of clusters needed for the file = 3

[1 Mark]

Total size of 3 clusters = 512×3 Bytes = 1,536 bytes

Wastage of space = $1,536 - 1,300 = 236$ Bytes

[0.5 marks x 2 = 1 Mark]

1. (d).

(i).

solution 1

A	B	C	D	F(A,B,C,D)
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

OR

Solution 2

A	B	C	D	F(A,B,C,D)
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

solution 1

[0.25 x 16 = 4 Marks]

$$F(A,B,C,D) = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D}$$

(ii)

$$F(A,B,C,D) = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D}$$

OR

$$F(A,B,C,D) = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D}$$

solution 2

$$F(A,B,C,D) = \bar{A}\bar{B}\bar{C}\bar{D} +$$

[2 Marks]

(iii) Logic Circuit

$$\bullet F(A,B,C,D) = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D}$$

OR

$$\bullet F(A,B,C,D) = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D}$$

OR

• Simplified Boolean Expression

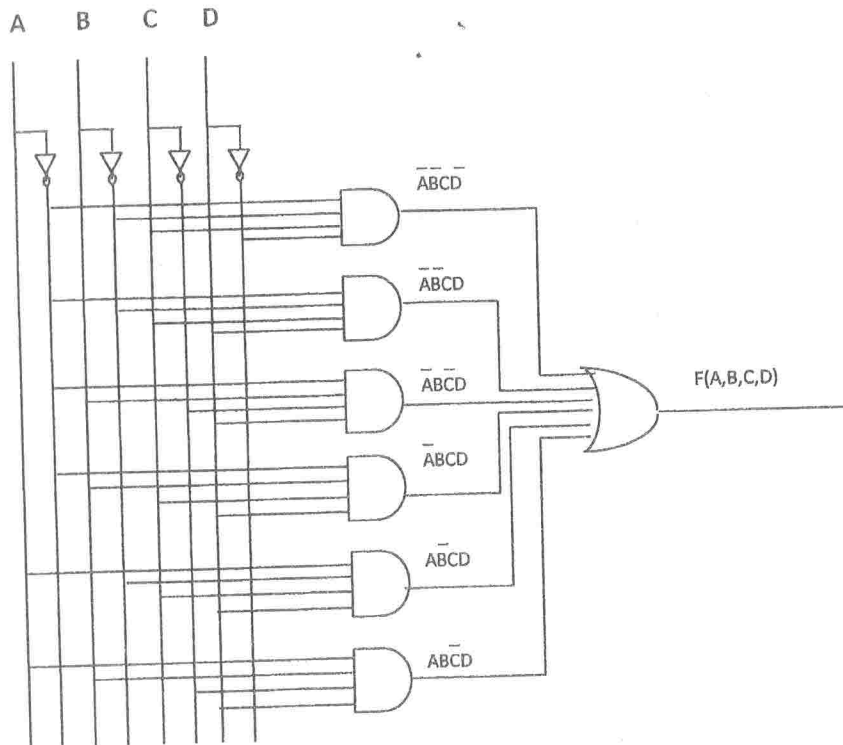
[2 Marks]

(As given below)

Logic circuit for

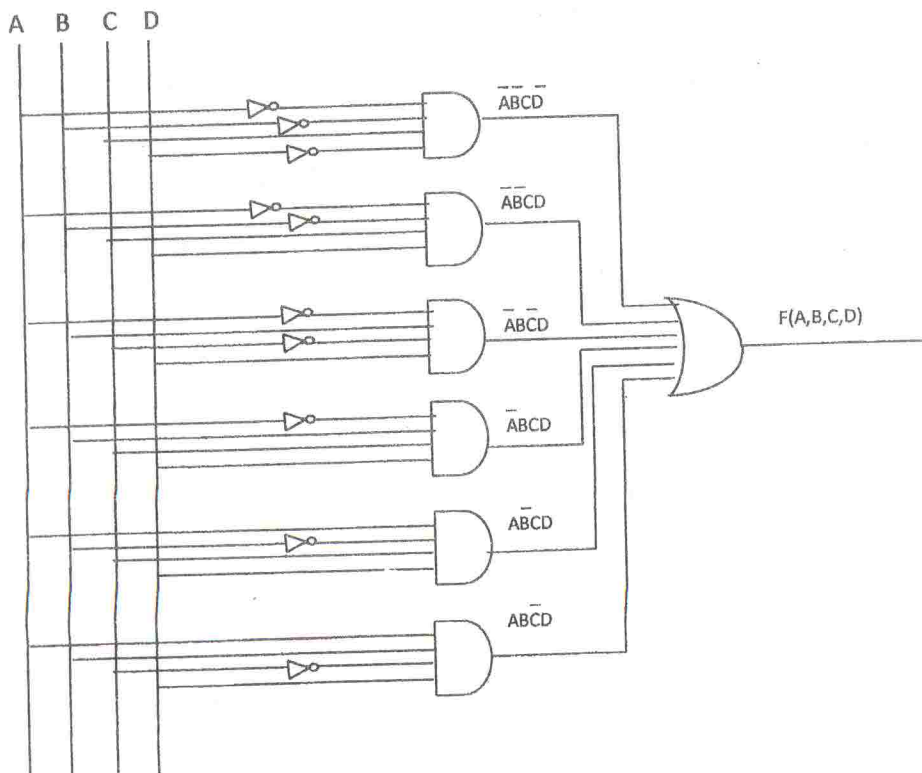
$$F(A,B,C,D) = \bar{A}\bar{B}CD + \bar{A}B\bar{C}D + \bar{A}BCD + A\bar{B}\bar{C}D + A\bar{B}CD + ABC\bar{D}$$

**



OR

**



OR

1st solution

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AB
AB

Simplified Boolean Expression using Boolean algebra or Karnaugh map

$$F(A,B,C,D) = \overline{A}\overline{B}\overline{C}\overline{D} + \overline{A}\overline{B}C\overline{D} + \overline{A}B\overline{C}\overline{D} + \overline{A}B\overline{C}D + \overline{A}B\overline{C}\overline{D}$$

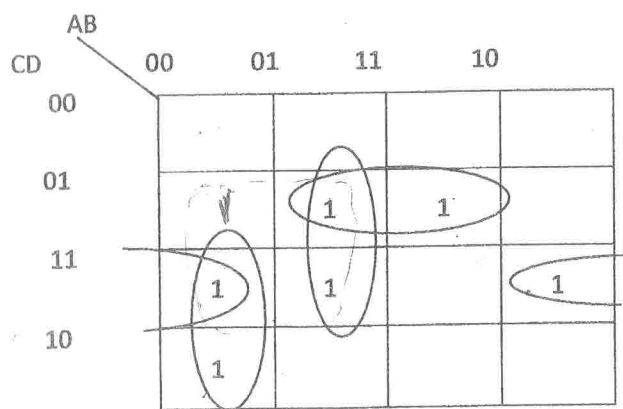
$$= \overline{A}\overline{B}(\overline{D}+D) + \overline{A}B\overline{C}(\overline{D}+D) + \overline{A}B\overline{C}\overline{D} + \overline{A}B\overline{C}D$$

$$= \overline{A}\overline{B} + \overline{A}B\overline{C} + \overline{A}B\overline{C}\overline{D} + \overline{A}B\overline{C}D$$

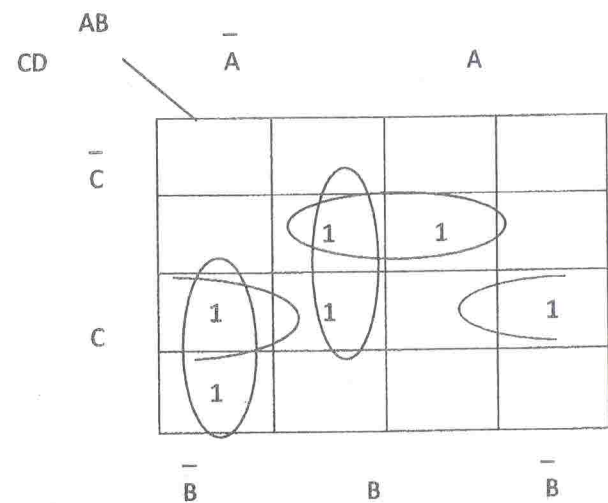
$$= \overline{B}C(\overline{A}+A) + BD(\overline{A}+A)$$

$$= \overline{B}C(\overline{A}+D) + BD(\overline{A}+C)$$

$$= \overline{A}\overline{B}C + \overline{A}BD + \overline{B}CD + B\overline{C}D \quad (\text{or any correct simplification})$$

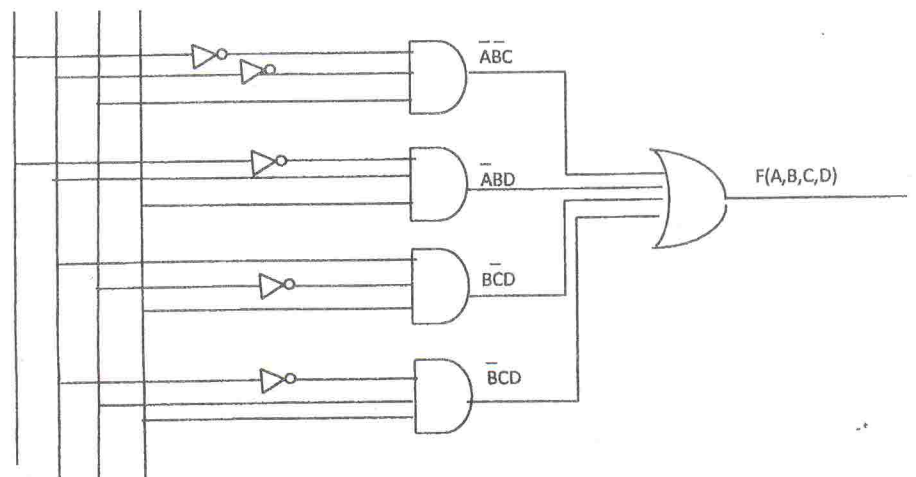


OR



$$F(A,B,C,D) = \overline{A}\overline{B}C + \overline{A}BD + \overline{B}CD + B\overline{C}D$$

A B C D



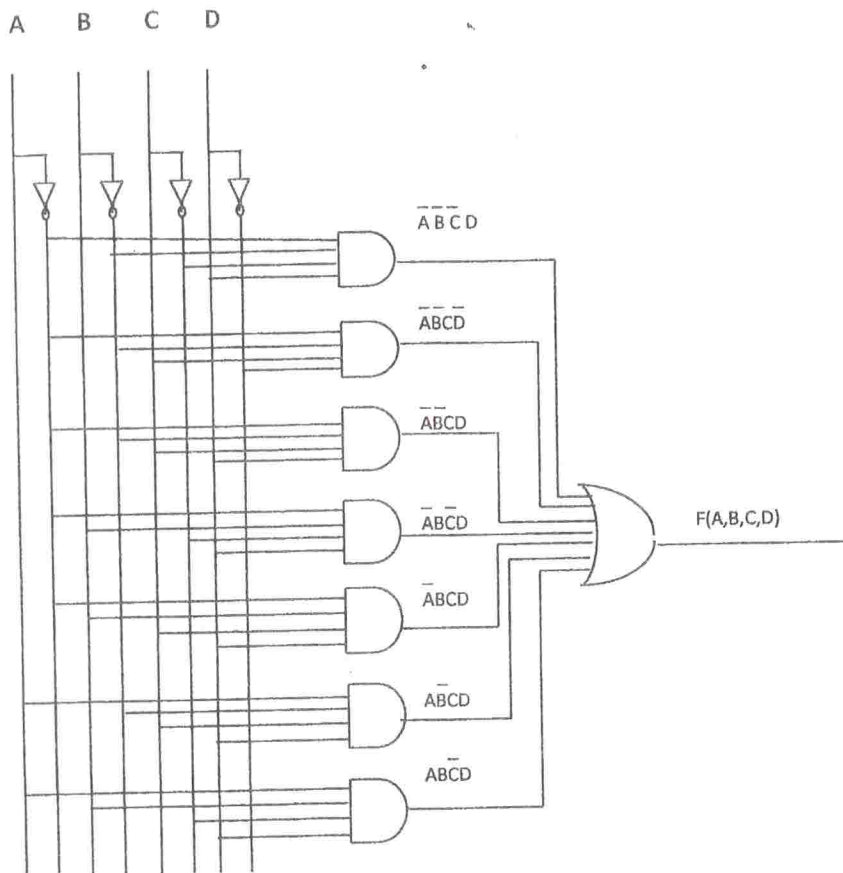
$$\overline{A}\overline{B}\overline{C}D + \overline{A}\overline{B}C\overline{D} + \overline{A}\overline{B}C\overline{D} + \overline{A}\overline{B}C\overline{D}$$

$$\overline{A}\overline{B}C\overline{D} + \overline{A}\overline{B}C\overline{D} + \overline{A}\overline{B}C\overline{D}$$

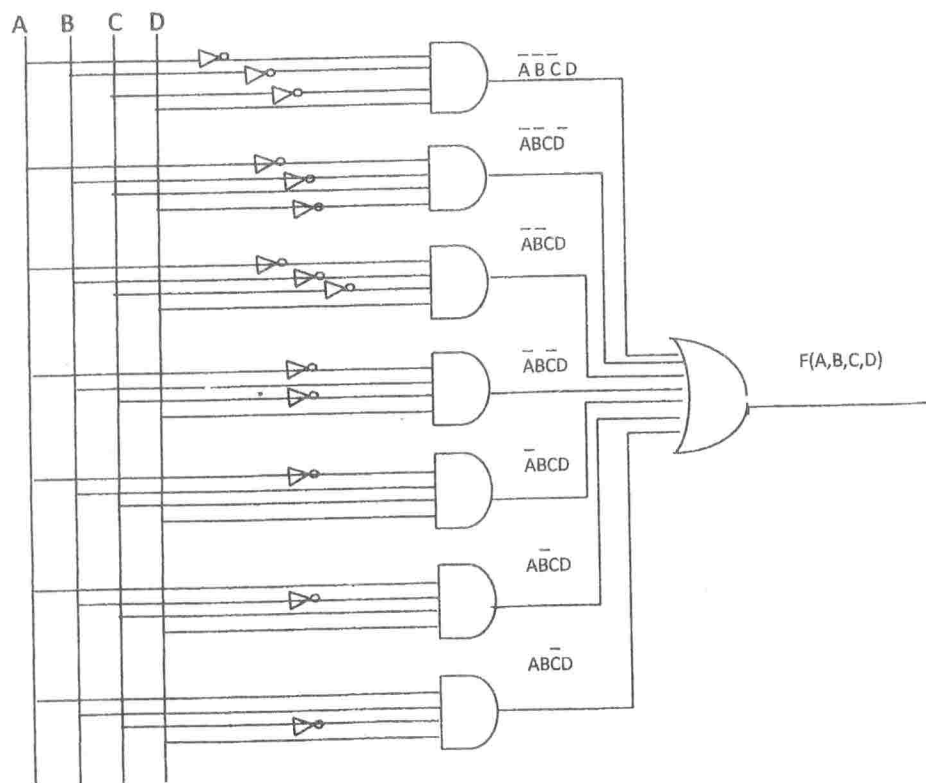
$$= \overline{A}\overline{B}C(\overline{D}+D) + \overline{A}\overline{B}C(\overline{D}+D)$$

Logic circuit for

$$F(A,B,C,D) = \overline{A}\overline{B}\overline{C}\overline{D} + \overline{A}\overline{B}\overline{C}D + \overline{A}\overline{B}C\overline{D} + \overline{A}\overline{B}CD + \overline{A}B\overline{C}\overline{D} + \overline{A}B\overline{C}D + \overline{A}BC\overline{D} + \overline{A}BCD$$



OR



Solution 2

OR

Simplified Boolean Expression using Boolean algebra or Karnaugh map

$$F(A,B,C,D) = \overline{A}\overline{B}\overline{C}\overline{D} + \overline{A}\overline{B}\overline{C}D + \overline{A}\overline{B}C\overline{D} + \overline{A}\overline{B}CD + \overline{A}B\overline{C}\overline{D} + \overline{A}B\overline{C}D + \overline{A}B\overline{C}D + \overline{A}B\overline{C}D$$

$$= \overline{A}\overline{B}(\overline{C}\overline{D} + \overline{C}D + C\overline{D} + CD) + \overline{A}BD(C + \overline{C}) + \overline{A}B\overline{C}D + \overline{A}B\overline{C}D$$

$$= \overline{A}\overline{B}(\overline{C}\overline{D} + C(\overline{D} + D)) + \overline{A}BD(C + \overline{C}) + \overline{A}B\overline{C}D + \overline{A}B\overline{C}D$$

$$= \overline{A}\overline{B}(\overline{C}\overline{D} + C) + \overline{A}BD + \overline{A}B\overline{C}D + \overline{A}B\overline{C}D$$

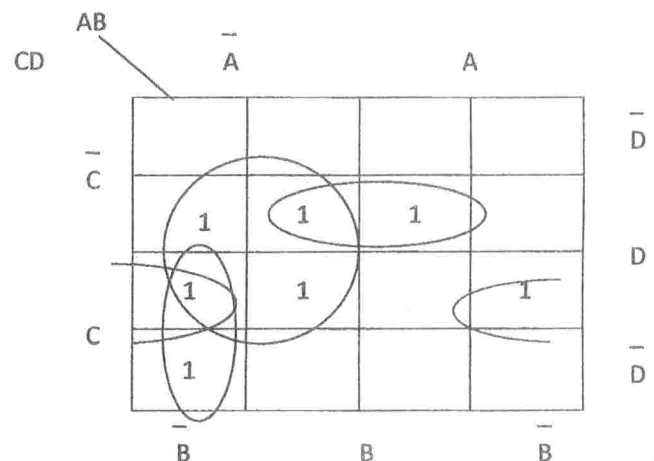
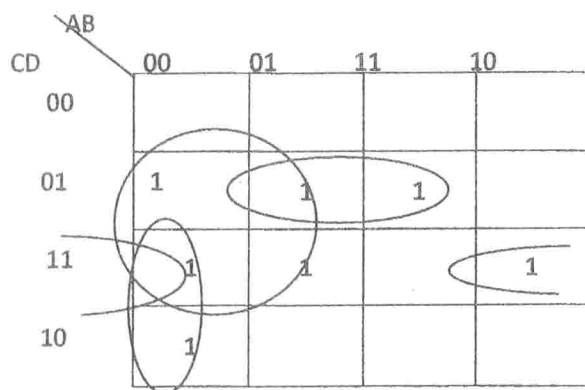
$$= \overline{A}\overline{B}(C + D) + BD(\overline{A} + \overline{A}C) + \overline{A}B\overline{C}D$$

$$= \overline{A}\overline{B}C + \overline{A}\overline{B}D + \overline{A}BD + \overline{A}B\overline{C}D + \overline{A}B\overline{C}D$$

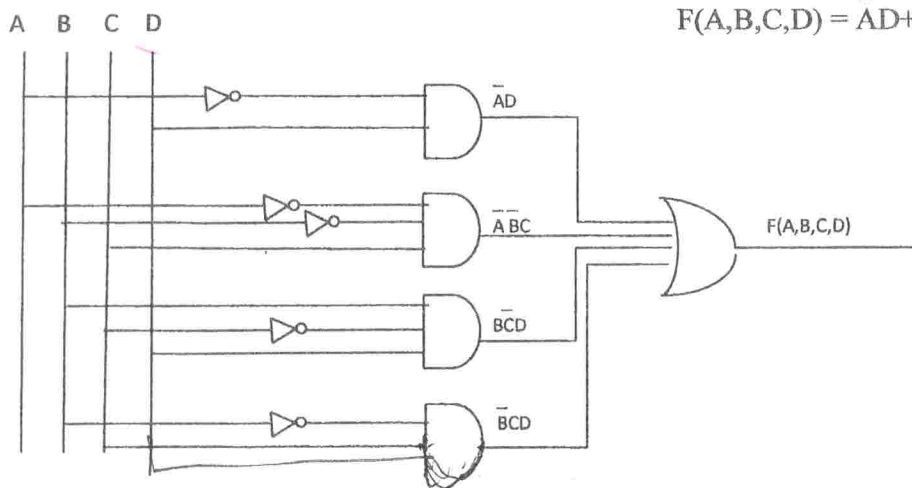
$$= \overline{A}D(\overline{B} + B) + \overline{B}C(\overline{A} + \overline{A}D) + \overline{B}CD$$

$$= \overline{A}D + \overline{A}\overline{B}C + \overline{B}CD + \overline{B}CD$$

(or any correct simplification)



**



$$F(A,B,C,D) = \overline{A}D + \overline{A}\overline{B}C + \overline{B}CD + \overline{B}CD$$

2. (a)

Elements :

- HTML documents are defined by HTML elements.
- Content starts with a valid tag and terminated with a valid corresponding tag.

[Any answer - 1 mark]

Attributes :

- Attributes provide additional information about elements.

[1 marks]

(b)

- (i) br: element - forces a line break wherever you place it.
- (ii) href: Attribute defines the link "address".
- (iii) src: attribute specifies the location of the image file
- iv) html: element defines the whole HTML document

[0.25 Mark for each element and functionality x 8 = 2 Marks] ~~[0.5 mark for each = 2 Marks]~~

- (c) (i) p{ color:blue; font-family:arial; font-size: 14pt}

[2 marks]

If the complete answer is not given sub-sections of the written answer can be given marks as below.

- p{ color:blue; font-family:arial; font-size: 14pt}

[If both underlined component are given - .5 mark]

- p{ color:blue; font-family:arial; font-size: 14pt}

[For each underline component - .5 mark for each]

(ii) Creates

- an anchor link
- when the user clicks on the image icon, "elephants_tnl.jpg", an image named "elephants.jpg" is loaded in a different web page.
- If the browser can't load the image "elephants_tnl.jpg" it displays the alternate text "Tour to Yala".
- The width and height of the image "elephants_tnl.jpg" are 288cm and 156 cm respectively.
- Turns off the border.

[0.5 marks for each = 3 Marks]

Note: The 2nd bullet contains two correct segments.

(iii) <input type = "radio" name = "visit" value = "Whale" >Blue Whale

 [Each underlined component 0.5 marks * 4 = 2 marks]

<input type = "radio" name = "visit" value = "Leopard" >Leopard

 <input type = "radio" name = "visit" value = "Elephant" >Elephant

 [0.5 mark for each = 1 marks]

(iv)

① Take as a single component	<table border = "1">	← ②
	<caption>Wild Sri Lanka</caption>	← ③
	<tr> <th>Days</th> <th>Price</th> </tr>	← ④
	<tr> <td>7</td> <td>US\$910</td> </tr>	← ⑤
	<tr> <td>10</td> <td>US\$1220</td> </tr>	← ⑥
	</table>	

td or th

[0.5 marks for each component *6 = 3 Marks]

Question 3

1)

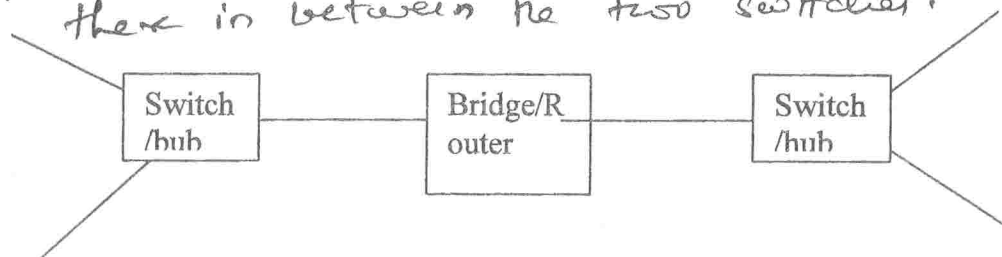
i) 255.255.255.240

[marks 2]

ii) Router or Bridge or L3 Switch (Layer 3 Switch)

[marks 1]

iii) At least one Bridge or Router should be there in between the two switches.



[Correct Answer Marks 2]

Partial Marks - Two segments drawn with with no link - 1 Mark]

Gateway address of network 1: 10.32.5.x where $x = 1 \dots 14$

Gateway address of network 2: 10.32.6.y where $y = 1 \dots 14$

[each correct answer $1 * 2 =$ marks 2]

IP addresses of computers network 1

10.32.5.n where $n = 1 \dots 14$ but not x

[marks 1]

IP addresses of computers network 2

10.32.6.m where $m = 1 \dots 14$ but not y

[marks 1]

[Do not give marks for duplicate ip numbers]

b).

- i. Compare TCP and UDP protocols in terms of reliability

TCP reliability high,
UDP is unreliable.

[2 Marks]

- ii. Peer-to-peer (P2P) and client-server models are distributed application architectures. Discuss the difference between them.

P2P partitions tasks or workloads between peers

[1 Mark]

In Client server, server takes the full load.

[1 Mark]

- iii. Distinguish between hubs and switches in a network.

Hub : When a packet arrives at one port, it is copied to all the other ports.

Switch : When a switch receives a packet, it sends the packet only to the particular destination port.

[1 for each x 2 = 2 Marks]

Question 4

a)

- Requirement (Elicitation and) Analysis.
- System Design.
- Implementation/Coding.
- Testing
- Maintenance.

[0.5 for each item identification x 5 = 2.5 Marks]

[0.5 for each item description x 5 = 2.5 Marks]

b) Functional requirements:

- Services expected by the user or
- Services provided by the system.

Non-Functional Requirements:

- System constraints/ limitations.

[1 for each x 2 = 2 Marks]

Mobile phone- functional:

- Make a call,
- receive a call,
- send an SMS,
- receive an SMS

[0.5 for any correct answers up to three x 3 = 1.5 Marks]

Mobile phone- non-functional:

- Size,
- price,
- battery life time,
- memory capacity,
- appearance

[0.5 for any correct answer up to two correct answers x 2 = 1 Marks]

- a) {
- Maintenance: Necessary modifications to meet the changing requirements.
 - Requirement Analysis: Identification of user requirements.
 - System Design: Development of a conceptual model to represent the actual system, which can be implemented
 - Implementation: convert the conceptual model to a collection of ~~computer~~ executable computer programs.
 - Testing: Identify the existence of errors and error
- 12

c) Unit testing:

- Purpose: To test the individual source programs for logical errors.
- People: Programmer/Software Engineer who developed the source code/program

5.

Integrated testing:

- Purpose: Unit tested source codes are combined as a group and test for (functionality, performance, and/or reliability) errors due to the integration.
- People: software engineers/programmers, senior SE/team lead/ project manager development people only)

Acceptance testing:

- Purpose: To test the requirements of a specifications or contract are met.
- People: people from software development team and clients/end users.

[0.5 for each purpose x 3 = 1.5 Marks]
[0.5 for each correct people involved x 3 = 1.5 Marks]

d)

Any explanation with the following key features is acceptable.

Decide the functionality

[0.5 Marks]

Decide the expected output

[0.5 Marks]

Conduct the test

[0.5 Marks]

Compare the actual behavior with the expected one.

[1 Mark]

5.

(a)

Computer (processor) cannot understand programs written in **any language other than machine code**. Therefore language translators are needed to translate such programs to **machine code** prior to their execution.

[2Marks]

(b)

First generation languages :

- 1) In Machine Code.
- 2) Execute very fast compared to other generation languages.
- 3) Tied up with the machine architecture.
- 4) Translators are not need to execute programs.

Second generation languages:

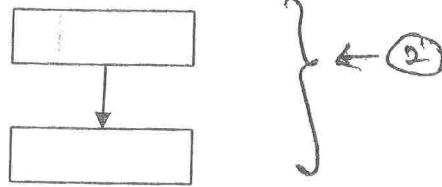
- 1) In assembly language
- 2) Mapping between assemble instructions and machine instruction is usually 1-1
- 3) Tied up with the machine architecture.
- 4) Assembler is needed to execute the program

Two features from each generation 2 – Mark

- Each correct answer 0.5 subjected to maximum 1 for each generation.

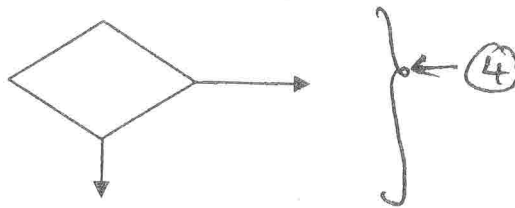
(c)

i. Sequence ← ①

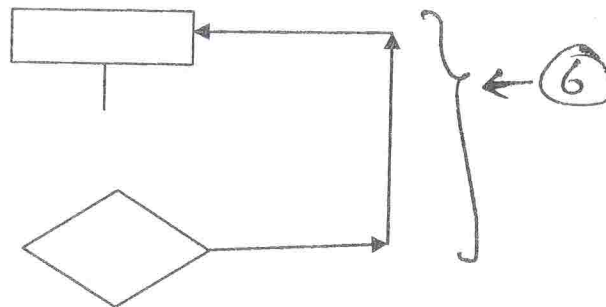


Element of the diagram can be any valid item. Only the sequence of one instruction followed by the other is important.

i. Branching (decision) ← ③



ii. Iteration (repetition) ← ⑤



All three control features are correct with the flow charts – 3 Marks

- Each correct answer = 0.5 marks (item or flowchart)

(d)

```
1  x = int(input("Enter an integer ->"))
2  while x != 0 :
3      bn = ""
4      while x > 1:
5          quotient = int(x / 2)
6          remainder = x % 2
7          bn = bn + str(remainder);
8          x = quotient
9          bn = str(x) + bn
10     print ("Binary Number -", bn)
11     x = int(input("Enter your number ->"))
```

Handwritten annotations: Circled numbers 1-8 with arrows pointing to specific lines or tokens. 1 points to line 1, 2 to line 2, 3 to line 3, 4 to line 4, 5 to line 7, 6 to line 8, 7 to line 10, and 8 to line 11. There are also arrows pointing to the closing parenthesis of the first input statement and the closing parenthesis of the second input statement.

Syntax errors

- a) Line No 1
 - i. String is not closed properly (“
 - ii. Need one more close bracket (“(“)
- b) Line No 3
 - i. bn variable should be right indented.
- c) Line No 6
 - i. Assignment operator should be = not ==
- d) Line No 7
 - i. No line terminator (“;”)
- e) Line No 8
 - i. Line should be indented with the previous line.
- f) Line 11
 - i. String is not closed properly (“
 - ii. Need one more close bracket (“(“)

All 8 correct with reasons – 4 Marks

- Each correct ^{line} error identification of an error 0.25 marks, error ^{identification} correction 0.25 mark

Logical errors

- a) Line 7 should be
 `bn = str(remainder) + bn`

If the order on the right hand side reversed, The binary number would be in the reverse order.

- b) Line 9 should be aligned with line 4 to capture the last bit.

```
3    x = int(input("Enter an integer ->"))
4    while x != 0 :
3        bn = ""
4        while x > 1:
5            quotient = int(x / 2)
6            remainder = x % 2
7            bn = str(remainder) + bn
8            x = quotient
9        bn = str(x) + bn
10    print ("Binary Number -", bn)
11    x = int(input("Enter an integer ->"))
```

All 2 corrections – 4 Marks

- **Each correction – 2 Marks**

6. (a) For this question valid business entities are

- Manufacture
- Wholesaler
- Retailer
- Service Provider

(i) Business to Business – Describes **electronic commercial transaction between businesses.**

[Each bold point 0.5 Marks x 2 = 1]

In the example both parties should be business entities.

Example : Delivering motor vehicles by the manufacturer to the wholesale dealer through on-line transactions.

[Each valid business party 0.5 Marks x 2 = 1]

Business to Consumer – Describes **electronic commercial transaction between business to a Consumer.**

[Each bold point 0.5 Marks x 2 = 1]

Example - Processing an on-line order to purchase a Mobile Phone, Computer, Food (Home delivery of food),

[Each valid business party 0.5 Marks x 2 = 1]

Consumer to Consumer – Describes **electronic commercial transaction between consumers.**

[Each bold point 0.5 Marks x 2 = 1]

Note : Transactions are generally performed through a facilitator e.g. Amazon.com, Craigslist.com, eBay.com or through a collaborative facilitation among consumers. e.g. e-commerce web portal for university students.

Example – Processing an on-line transaction to purchase a text book by one consumer from another consumer. (The latter is also a member of the same community)

[Each valid business party 0.5 Marks x 2 = 1]

g. - B2C
C2C - B2B
B2B

(ii) B2E Most appropriate tool - email

[1 Mark]

Justification :

- Simple and easy to use,
- Easy to obtain.
- Easy to access from low-end electronic devices.
- Each individual can have his/her own email address,
- Delivery of messages guaranteed,
- Privacy/Security assured,
- Different email groups can be formed among the entire community to communicate at different levels,
- a tool like webmail can provide wider access facility,
- Each individual can communicate with his/her peer groups independently.

[1 Mark for each valid justification up to 2 = 2 Marks]

(b) (i) Agent - A software agent is a computer program which works autonomously towards goals in a dynamic environment on behalf of another entity over extended period of time,

[0.5 marks for each characteristic * 4 = 2 Marks]

(ii) Characteristics

- Autonomous
- Intelligent
- Performs in dynamic environments
- Able to interact with massively increasing information
- Self-governed. i.e. No direct supervision or control required,
- Flexible to a significant degree
- Interacts with other agents competitively or collaboratively
- Works over extended period of time
- Creative (to transform goals into active tasks)
- Community – predefined or open-ended

[1 mark for each correct answer up to 2 = 2 marks]

(iii) Examples

- Transportation: Agents can be a part of an user-friendly transportation system which perform intelligently by adjusting to the dynamic environment.
- Defense : In a battle field agents interact autonomously with the enemy by changing the strategies according to the tactics used by the enemy.
- Web Crawler : An Agent can be a server-based program that continuously or periodically scan the web or selected portions of the web looking for information of interest.
- Web Browser : An agent can provide the client side user interface for a sophisticated network application which may be an intelligent web browser
- Robot as an Agent : The agent in the robot interacts with the environment. Robot (agent) is capable of reacting to the changing environment.
- Agent interacting with a Robot : Agent in the environment can interact with the Robot which acts dynamically.
- User Interface : Agent acts as an interactive program that presents a very user-friendly interface to perform specific tasks as directed by the user.

[Any valid example 1 Marks + Correct explanation 1 Mark = 2 Marks]