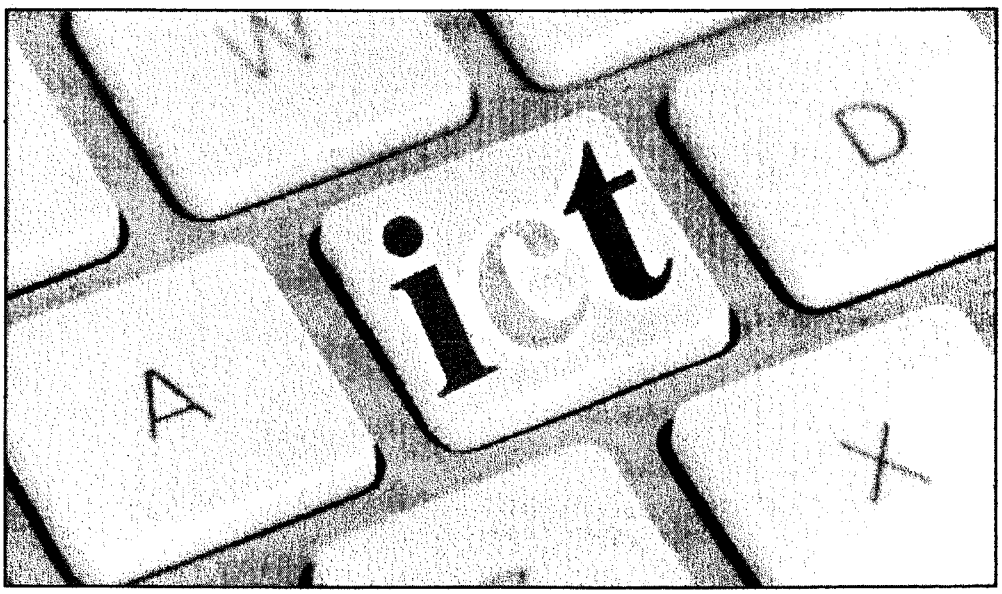
Confidential

Department of Examinations - Sri Lanka

G.C.E. (A/L) Examination - 2018

20 - Information & Communication Technology

Marking Scheme



This document has been prepared for the use of Marking Examiners. Some changes would be made according to the views presented at the Chief Examiners' meeting.

Amendments to be included

20 - Information and Communication Technology

Distribution of marks

Paper I

Time Duration 02 hours

Number of Questions 50

Total Marks 50 × 2 = 100

Paper II

Time Duration 03 hours

Paper A - Structured Questions

Number of Questions 04

04 × 10 = 40

Paper B - Essay Questions

Number of Questions 04

04 × 15 = 60

Paper II Total marks = 40 + 60 = 100

$$\text{Final marks} = \frac{pape\ I + Paper\ II}{2}$$

$$= \frac{100+100}{2} = 100$$

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2018 අගෝස්තු
கல்விப் பொதுத் தராதர பத்திர (உயர் தர)ப் பரீட்சை, 2018 ஓகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2018

24.08.2018 / 1400 - 1600

තොරතුරු හා සන්නිවේදන තාක්ෂණය I
தகவல், தொடர்பாடல் தொழினுட்பவியல் I
Information & Communication Technology I

20 E I

පැය දෙකයි
இரண்டு மணித்தியாலம்
Two hours

Instructions:

- *Answer **all** the questions.*
- *Write your **Index Number** in the space provided in the answer sheet.*
- *Instructions are also given on the back of the answer sheet. Follow those carefully.*
- *In each of the questions **1** to **50**, pick one of the alternatives from (1), (2), (3), (4), (5) which is **correct or most appropriate** and **mark your response on the answer sheet with a cross** (×) **in accordance with the instructions given on the back of the answer sheet.***
- *Use of calculators is **not allowed**.*

1. Consider the following three numbers in decimal, octal and hexadecimal notations, respectively.

A - 231_{10}
B - 347_{8}
C - $E7_{16}$

Which of the above is/are equivalent to 11100111_{2} in binary notation?

(1) A only (2) B only (3) A and C only (4) B and C only (5) All A, B and C

2. What is the decimal equivalent to the binary 110101.11_{2}?

(1) 53.00_{10} (2) 53.50_{10} (3) 53.75_{10} (4) 54.25_{10} (5) 54.75_{10}

3. Which of the following describes the term 'telecommuting'?

(1) ability of an employee to perform duties conveniently from different geographical locations using modern technology
(2) having online meetings with people at different geographic locations
(3) using ICT for community services
(4) using web-based applications to retrieve information
(5) performing financial transactions online

4. Consider the following statements.

A - Word size is the number of bits processed by the CPU of a computer in a single action (instance).
B - Data bus width and register width are directly related to word size of a computer.
C - Word size of modern general purpose computers is either 32 or 64 bits.

Which of the above statements is/are correct?

(1) A only (2) B only (3) C only
(4) B and C only (5) All A, B and C

5. Consider the following statements.

A - In public key encryption systems each pair of communicating entities share a single key for encryption and decryption.
B - Phishing is a type of social engineering attack often used to steal user data such as user name and password.
C - Port scanning is a method which can be used by attackers to identify open ports or services on a network host.
D - Digital signatures can be used for email message authentication.

Which of the above statements are correct?

(1) B and C only (2) A, B and C only (3) A, C and D only
(4) B, C and D only (5) All A, B, C and D

6. Consider the following statements.

A - DHCP server in an IP network dynamically allocates IP addresses to network devices.
B - DNS server translates domain names to IP addresses.
C - FTP server caches the recently accessed web pages.

Which of the above statements is/are correct?

(1) A only (2) B only (3) A and B only
(4) B and C only (5) All A, B and C

7. Consider the following statements.

A - TCP is a connection oriented and a reliable protocol.
B - UDP is a connectionless and an unreliable protocol.
C - TCP and UDP are transport layer protocols.

Which of the above statements is/are correct?

(1) A only (2) B only (3) A and B only
(4) B and C only (5) All A, B and C

8. In the OSI reference model, the network layer is responsible for ..... communication.

Which of the following is suitable to fill the blank in the above statement?

(1) node to node (2) source to destination (3) hop to hop
(4) switch to router (5) process to process

9. Which of the following indicates the number of host bits and the number of IP addresses respectively in a class C network?

(1) 8 and 256 (2) 8 and 65536 (3) 16 and 256
(4) 16 and 65536 (5) 24 and 256

10. To which of the following network classes does the IP address 192.248.254.1 belong?

(1) A (2) B (3) C (4) D (5) E

11. In the OSI reference model, a protocol data unit of the network layer is referred to as a ..... .

Which of the following terms is suitable to fill the blank in the above statement?

(1) frame (2) segment (3) window (4) message (5) packet

12. Which of the following correctly lists the given computer storage components in the **descending** order of **access speed**?

(1) cache memory > main memory > magnetic disk > register
(2) magnetic disk > main memory > cache memory > register
(3) magnetic disk > main memory > register > cache memory
(4) register > cache memory > main memory > magnetic disk
(5) register > main memory > magnetic disk > cache memory

13. Consider the following computer memory types.

A - CMOS memory
B - cache memory
C - flash memory
D - hard disk
E - RAM
F - registers

Which of the above are *volatile* memory types?

(1) A, C and D only (2) A, D and E only (3) A, E and F only
(4) B, E and F only (5) C, E and F only

14. Consider the following statements regarding HTML.

A - HTML frames are used to divide a browser window into multiple sections.

B - The *rows* attribute of <frameset> tag defines the number of vertical frames in an HTML page.

C - <frameset cols="100, 500, 100"> creates vertical frames with the specified number of millimetres.

Which of the above statement/s is/are correct?

(1) A only (2) B only (3) A and B only

(4) B and C only (5) All A, B and C

15. Consider the following HTML code with labels ❶ – ❸ and the expected output.

HTML code	Expected output
<html> *<head> <title>Coffee Shop</title> </head>* *<body>* <❶> <❷>*Coffee*</❷> <❸>*black hot drink*</❸> <❷>*Milk*</❷> <❸>*white cold drink*</❸> </❶> *</body>* *</html>*	Coffee black hot drink Milk white cold drink

What is the correct order of tags for replacing the labels ❶, ❷ and ❸ ?

(1) dt, dl, dd (2) dl, dt, dd (3) dd, dt, dl

(4) dt, dd, dl (5) dl, dd, dt

16. Consider the following HTML code for creating a table.

```
<html>
<head><style> table, th, td {border: 1px solid black} </style>
</head><body>
<table>
<tr><th> Name: </th> <td> Kamal </td> </tr>
<tr><th rowspan="2"> Telephone: </th> <td> 55577854</td> </tr>
<tr><td> 55577855 </td> </tr>
</table>
</body>
</html>
```

Which of the following is the output generated by the above code?

(1)

Name:	Kamal
Telephone:	55577854
	55577855

(2)

Name:	Telephone
Kamal	55577854
	55577855

(3)

Name: Telephone:
Kamal 55577854
55577855

(4)

Name: Kamal
Telephone: 55577854
55577855

(5)

Name:	Kamal
Telephone:	55577854
	55577855

17. Which of the following is the correct HTML statement for inserting an image?

(1) <img href="image.gif" alt="MyImage">

(2) <img alt="MyImage">image.gif</img>

(3) <img src="image.gif" alt="MyImage">

(4) <image src="image.gif" href="MyImage">

(5) <img href="image.gif" src="MyImage">

18. Consider the space voyage for landing a human being on the surface of the moon for the first time in 1969. The entire event was broadcast on the radio in Sri Lanka by several commentators based in Sri Lanka and the USA.

Which of the following events relates to the highest value of information?

(1) counting down for the launching of the rocket that carried the space shuttle
(2) the moment the space shuttle escaped from the gravitational field of the earth
(3) the moment the space shuttle entered the moon's gravitational field
(4) the moment the astronaut Neil Armstrong placed his first step on the surface of the moon
(5) the moment the astronauts landed on the sea in their return voyage to earth

19. Consider the following statements related to the development of computers over time.

A - Both processing speed and power consumption of computers have increased.
B - Processing speed of a computer has increased while physical size of a computer has decreased.
C - Both power consumption and the physical size of a computer have reduced.

Which of the above statements is/are correct?

(1) A only (2) B only (3) A and B only
(4) B and C only (5) All A, B and C

20. Consider the following statements.

A - Providing the personal information of customers stored in a computer by a vehicle servicing centre to an insurance agent is, an issue related to the privacy of customers.
B - Providing a copy of a single user licensed software to another party is a piracy issue related to the copyright owner of the software.
C - Unauthorized access to another person's computer is both illegal and unethical.

Which of the above statements is/are valid?

(1) A only (2) B only (3) A and B only
(4) B and C only (5) All A, B and C

21. Consider the following Boolean expression.

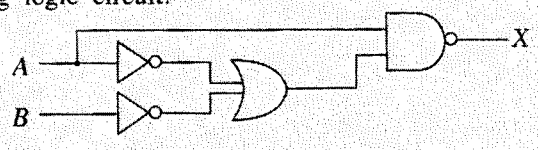
$\overline{A + B \cdot \overline{C}}$

Which of the following is/are equivalent to the above expression?

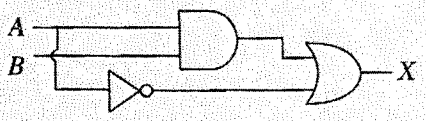
I. $\overline{A} + \overline{B} \cdot C$
II. $\overline{A} \cdot \overline{B \cdot \overline{C}}$
III. $\overline{A} \cdot \overline{B} + \overline{A} \cdot C$

(1) I only (2) II only (3) III only (4) I and II only (5) II and III only

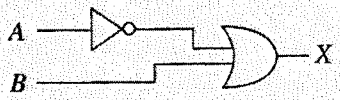
22. Consider the following logic circuit.



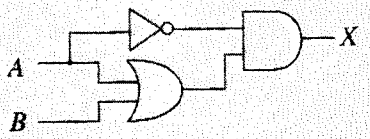
Which of the following circuit/s is/are equivalent to the above circuit?



I



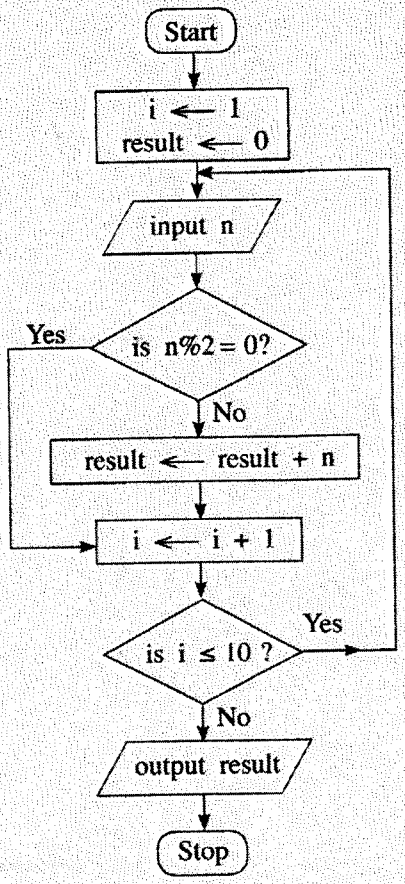
II



III

(1) I only (2) II only (3) III only (4) I and II only (5) All I, II and III

● Questions **23** - **25** are based on the flowchart below. (Note that **n%2** represents **n mod 2**.)



23. Which of the following is/are correct regarding the algorithm expressed by the above flowchart?

A - It takes 10 inputs.

B - It computes the sum of the even numbers in the input.

C - To take 100 inputs, only modifying "is $i \leq 10$?" will be sufficient.

(1) A only (2) B only (3) C only (4) A and B only (5) A and C only

24. If the following were fed as inputs to the above algorithm, what will be the output?

2, 8, 9, 3, 4, 10, 6, 5, 13, 19, 12, 7

(1) 10 (2) 30 (3) 42 (4) 49 (5) 56

25. For any given input, outputs of which of the following Python programs will be the same as the output produced by the algorithm in the above flowchart?

I –
```
i = 1
result = 0
while (i <= 10):
    n = int(input())
    if (n % 2 != 0):
        result += n
    i = i+1
print result
```

II –
```
result = 0
for i in range(10):
    n = int(input())
    if (not(n % 2 == 0)):
        result = result + n
print result
```

III –
```
result = 0
i = 1
while True:
    n = int(input())
    if (not(n % 2 == 0)):
        result = result + n
    i = i + 1
    if (i > 10):
        break
print result
```

(1) I only (2) II only (3) III only (4) I and II only (5) All I, II and III

26. Consider the following statements regarding databases.

A - Candidate key is a column, or a set of columns that can uniquely identify a row in a table.
B - Alternate key is any candidate key that has not been selected as the primary key.
C - Primary key can have a NULL value.

Which of the above statements is/are correct?

(1) A only (2) B only (3) A and B only
(4) A and C only (5) All A, B and C

27. Consider the following statements relevant to external entities of Data Flow Diagrams.

A - An external entity can be a person, system or organization that has predefined behaviour.
B - An external entity can be a source of input data for a process or/and a destination of the output of a process.
C - External entities are always data stores.

Which of the above statement(s) is/are correct?

(1) A only (2) B only (3) A and B only
(4) B and C only (5) All A, B and C

28. Consider the following relational schema in a database.

Subject (*SubjectID, TermID, SubjectDescription*)

Here the *SubjectID*, *TermID*, and *SubjectDescription* are ..... and *Subject* is ..... .

Which of the following are most suitable to fill the blanks, respectively?

(1) attributes, a relation (2) relations, an attribute
(3) tuples (records), a relation (4) tuples, an attribute
(5) relations, a tuple

29. Consider the following tasks.

A - identifying the problems in the existing system
B - suggesting alternative solutions
C - prioritizing of the information system's requirements

Which of the above tasks is/are carried out during the preliminary investigations of systems development life cycle?

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

30. Which of the following feasibility types is generally **not** carried out during the development of a system to be used only in-house?

(1) economic feasibility (2) market feasibility (3) operational feasibility
(4) organizational feasibility (5) technical feasibility

31. Consider the following statements related to e-business.

A - *Brick-and-click* is a business model by which a company integrates both offline and online presence of the business.
B - *Pure-brick* is a business model in which a company has only a physical presence.
C - *Pure-click* business has the presence only on the Internet.

Which of the above statements is/are correct regarding e-business models?

(1) A only (2) B only (3) C only
(4) A and C only (5) All A, B and C

32. A smart home application that automates the controlling of lighting, temperature, entertainment systems, and appliances is an example for

(1) evolutionary computing. (2) multi-agent systems.
(3) nature inspired computing. (4) software agents.
(5) ubiquitous computing.

33. Consider the following statements regarding artificial intelligence.

A - Artificial intelligence systems can be used in email spam filters.
B - Artificial intelligence systems are capable of analyzing uncertain information.
C - An artificial intelligence system is a system for capturing, storing, processing, and displaying data related to positions on earth's surface.

Which of the above is/are correct?

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

34. Consider the following statements regarding programming languages and program translation.

A - A compiler translates a program one statement at a time.
B - An assembler converts a program in an assembly language into machine code.
C - An interpreter scans the entire program and translates it as a whole into machine code.

Which of the above statements is/are correct?

(1) A only (2) B only (3) C only
(4) A and C only (5) B and C only

35. What is the value of the following Python expression?

```
(5**2) // 3 ^ 4
```

(1) 3 (2) 5 (3) 7 (4) 12 (5) 4096

36. Consider the following statements.

A - Disk defragmentation makes files that are fragmented in a disk, contiguous.
B - Swapping is a memory management technique where the main memory contents which were not recently used are copied to disk to make the memory available for other processes.
C - A File Allocation Table (FAT) is a table that an operating system maintains which provides a map of the clusters that a file has been stored in.

Which of the above is/are correct?

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

37. Through which of the following, will a device controller that controls a device deal with the operating system?

(1) application software (2) assembler (3) compiler
(4) device driver (5) utility software

38. Consider the following statements relevant to the trends in modern information technology.

A - In traditional computing, data is encoded into binary digits while in quantum computing data is represented in quantum bits or qubits.
B - A wearable device capable of activity tracking that measures data such as the number of steps walked and heart rate is an example for a sensor network.
C - A collection of nodes capable of environmental sensing, local computation, and communication with its peers or with other higher performance nodes is called a Geographic Information System.

Which of the above statements is/are correct?

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

39. Consider the following statements regarding databases.

A - For each attribute of a relation, there is a set of permitted values, called the *domain* of that attribute.

B - The tuples (records) of the relations are always in sorted order.

C - Database schema shows the organization of data as a blueprint of how the database is constructed.

Which of the above statements is/are correct?

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

- Consider the following relational schema consisting of text fields in answering questions **40** and **41**.

Students (admission_number, surname_with_initials, house_number, street_name, village, postal_town, postal_code)

Assume that for a given *postal_town* only one *postal_code* exists.

40. Consider the following statements.

A - *Students* relation is not normalised.

B - *Students* is a relation in First Normal Form (1NF) only.

C - In normalization terms, *Students* is a relation in Second Normal Form (2NF) and hence also in 1NF.

Which of the above statements is/are correct?

(1) A only (2) B only (3) A and C only
(4) B and C only (5) All A, B and C

41. Which of the following is displayed as output if the query:

*Select * from Students where postal_code* ='10120' *and house_number* ='30A';

is executed?

(1) postal_code of all records
(2) postal_code and house_number of records having postal_code as '10120' and house_number as '30A'
(3) postal_code and house_number of all records
(4) all fields of records having postal_code as '10120' and house_number as '30A'
(5) all fields of all records

42. Consider the following statements relating to Entity Relationship (ER) modelling.

A - Cardinality specifies how many instances of an entity relates to one instance of another entity.

B - An entity is a 'thing' or 'object' in the real world that can be identified separately (distinguishable) from all other objects.

C - Cardinality specifies primary key attributes of an entity.

Which of the above is/are correct?

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

43. Consider the following statements regarding functional and non-functional requirements of a sales system.

I - Reads barcodes of items purchased and produces the invoice

II - Accepts user's request and responds in less than 1 second

III - Processes a minimum of 1,000 transactions per second

Which of the following is the correct classification of requirements?

(1) I, II and III all functional
(2) I – functional, II and III – non-functional
(3) II – functional, I and III – non-functional
(4) I and III – functional, II – non-functional
(5) I, II and III all non-functional

44. Consider the following software development lifecycle models.

A - spiral
B - waterfall
C - Rapid Application Development (RAD)

Which of the above requires defining and finalizing requirements in the early phases of the lifecycle?

(1) A only (2) B only (3) A and B only
(4) A and C only (5) B and C only

45. Consider the following statements regarding *Structured* and *Object Oriented* software development methodologies.

A - Structured analysis and design represents systems as a hierarchy of functions.
B - Structured design is a system of interacting objects.
C - Object oriented methodology combines data and processes into individual entities.

Which of the above statements is/are correct?

(1) A only (2) A and B only (3) A and C only
(4) B and C only (5) All A, B and C

46. What is the output of the following Python code segment if executed with 30 as input?

```
n = int(raw_input())
if (n < 40):
    result = 1
    if (n < 10):
        result = 2
    elif (n < 20):
        result = 3
    else:
        result = 4
else:
    result = 5
print result
```

(1) 1 (2) 2 (3) 3 (4) 4 (5) 5

47. What is the output of the following Python code segment?

```
s = 0
for i in range(10):
    s = s + i
print s
```

(1) 0 (2) 10 (3) 45 (4) 55 (5) 100

48. What is the output of the following Python code segment?

```
aList = [2,3,11,13,5,7]
s = 0
for i in range(len(aList)):
    if (aList[i] > 10):
        continue
    s = s + aList[i]
print s
```

(1) 0 (2) 5 (3) 16 (4) 17 (5) 41

49. Consider the following Python code segment with a blank line. (The line numbers on the left are shown for guidance only. They are not part of the code).

```
1    # Function definition starts
2    .....
3            s = arg1 + arg2
4            return s
5    # Function definition ends
6    total = sum(10,20)
7    print total
```

The above code should consist of a programmer defined function named 'sum'. Which of the following should be entered in the blank on line 2, so that the function 'sum' is correctly defined?

(1) sum(arg1, arg2):
(2) def sum(arg1, arg2):
(3) function sum(arg1, arg2):
(4) def sum(arg1, arg2, s):
(5) def sum( ):

50. Consider the following statements.

A - BIOS is an example for application software.
B - A utility software is an example for firmware.
C - Spyware is an example for malware.

Which of the above is/are correct?

(1) A only
(2) B only
(3) C only
(4) B and C only
(5) All A, B and C

* * *

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்
අ.පො.ස. (උ.පෙළ) විභාගය/ க.பொ.த. (உயர் தர)ப் பரீட்சை - 2018

විෂයය අංකය பாட இலக்கம்	20	විෂයය பாடம்	Information & Communication Technology

ලකුණු දීමේ පටිපාටිය/புள்ளி வழங்கும் திட்டம்
I පත්‍රය/பத்திரம் I

ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.
01.	5	11.	5	21.	2	31.	5	41.	4
02.	3	12.	4	22.	2	32.	5	42.	2
03.	1	13.	4	23.	5	33.	2	43.	2
04.	5	14.	1	24.	4	34.	2	44.	2
05.	4	15.	2	25.	5	35.	4	45.	3
06.	3	16.	1	26.	3	36.	5	46.	4
07.	5	17.	3	27.	3	37.	4	47.	3
08.	2	18.	4	28.	1	38.	1	48.	4
09.	1	19.	4	29.	3	39.	3	49.	2
10.	3	20.	5	30.	2	40.	All	50.	3

✪ විශේෂ උපදෙස්/ விசேட அறிவுறுத்தல் :

එක් පිළිතුරකට/ ஒரு சரியான விடைக்கு 01 ලකුණු බැගින්/புள்ளி வீதம்

මුළු ලකුණු/மொத்தப் புள்ளிகள் 2 × 50 = 100

Information and Communication Technology 20/E/II (English) -2018

Marking Scheme

Part A.

Special Notes:

i. .../.../... indicate only one of the options included are considered as one answer
ii. Underlined key words or synonyms are mandatory in a given answer
iii. [..] {} indicates marking guidelines
iv. If any amendments are made during 9th September 2018 meeting such changes need to be correctly written in the cages provided on page 25-26 and verified with the panel/chief examiners by the individual examiner.

Answers & Marking Guide:

1. (a) (i) State two benefits of using Cascading Style Sheets (CSS).

(1) .....

(2) .....

i. Easy maintenance and update web pages
ii. Style sheets guarantee consistency throughout website
iii. re-styling of any document, without modifying the original HTML
iv. A single document can be presented in multiple styles by using multiple style sheets (Multiple Device Compatibility)
v. More formatting options
vi. Present different styles to different users/ Ease of presenting different styles to different viewers
vii. Pages load faster /lightweight code/ The smaller the files the faster the download. Using style sheets can help minimize file sizes / CSS reduces code duplication
viii. Search engine optimization benefits
ix. Cleaner code

[1 mark * 2 = 2 marks
Total = 2 marks]

(ii) Write the output of the following HTML code segment when rendered by a web browser.

```
<html>
<body>
<u> Important Sites </u>
<ul>
  <li> <a href="www.nie.lk/index.html"> National Institute of Education </a></li>
  <li> <a href="www.doenets.lk/exam/index.html"> Department of Examinations </a></li>
</ul>
</body>
</html>
```

Important Sites

- National Institute of Education
- Department of Examination

[0.5 marks for heading with underline text (Important Sites)

0.5 marks for bullet list with hyperlink

Total = 1 mark]

(iii) Write the output of the following HTML code segment when rendered by a web browser.

```
<html>
<body>
<p>
<center> Department of Examinations <br> Pelawatta
<br> Battaramulla </center></p><hr>
</body>
</html>
```

Department of Examination
Pelawatta
Battaramulla

[0.5 marks for three centered text lines
0.5 For the hardline
Total = 1 mark]

{Total for 1. (a) = 4 marks}

(b) Consider the following HTML code segment:

```
<body>
   <h1> Introduction to Web Technologies </h1>
   <h3> HTML </h3>
   <p> HTML is the standard markup language for creating web pages </p>
</body>
```

Write down the internal styles required to apply the styles mentioned in the following table for the elements *h1* and *p* in the above code segment.

Element Name	Attribute	Attribute Value
h1	*color* *text-align* *font-family*	*blue* *centre* *Arial*
p	*background color* *font size*	*Yellow* *12px*

```
<style>
h1 { color : blue;
     text-align : center/centre;
     font-family :Arial;
   }

P { background-color : yellow;
    font-size : 12px;
  }

</style>
```

[0.5 for starting and closing 'style' tags]

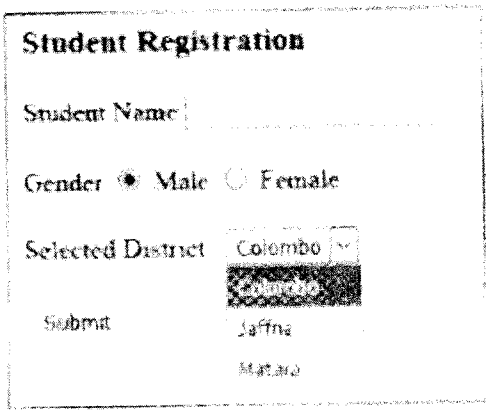
[1 mark] (Note: 'centre' also acceptable due to typographical error in the table given)

[0.5 mark]

{Total for part b = 2 marks}

(c) Consider the HTML form given below rendered by a web browser.

This is a registration form used for registering students. It is required to enter *Student Name* as a text input, select *Gender*, select *District* and then click *Submit* button. Complete the following HTML code segment by filling the spaces to display the form.



```
<html>
<head>
</head>
<body>
<h3>Student Registration </h3>
<form action="" method="post">
    .....</form>]
<div>
    Student Name <input type="text" name="name">
    mark]
</div>
<br>
<div>
Gender
<input type="radio" name="ptype" value="male" checked> Male
<input type="radio" name="ptype" value="female" > Female

    [0.5 mark]
</div>
<br>
<div>
Selected District :
<select name="city">
    select tags]
 <option value="Colombo"> Colombo </option>
 <option value="Jaffna" > Jaffna </option>
 <option value="Matara"> Matara</option>
    correct order]
</select>


</div>
<br>
<input type="submit" name="submit" value="Submit">
    mark]
</form>
</body>
</html>
```

[0.5 mark for <form>

[0.5

[0.5 mark]

[0.5 for both open and close

[0.5 for all three options in

[1

(Note: both ' and " are acceptable in answer)

{Total for 1.(c) = 4 mark}

[TOTAL MARKS FOR Q1 10 MARKS]

2. (a) Match each of the given phrases (i)-(viii) relating to e-commerce with the most suitable term from the list below.

List = {*brick-and-click, content provider, e-commerce, group purchasing, information broker, online marketplace, pure-brick, pure-click, reverse auction, virtual community, virtual storefront*}

Phrases:

(i) allows third party businesses (other businesses) to sell their products and services through the website and charge a percentage of the sale value as the fee

(ii) provides frequently updated material such as news, blogs, videos etc. online

(iii) allows sharing common interests and ideas over the Internet

(iv) consumer transactions are processed by the business operator's web portal and then delivered and fulfilled by the participating retailers or wholesalers

(v) has a physical shop as well as an online shop

(vi) is a business that collects publicly available data about consumers on the internet, analyzes and summarises them and sells that information to other parties

(vii) the sellers compete to obtain business from the buyer using the internet and prices may typically decrease as the sellers underbid each other

(viii) obtain discounts from vendors on the internet based on the collective buying power of members

Note: Write only the matching term against the phrase number.

(i) .....

(ii) .....

(iii) .....

(iv) .....

(v) .....

(vi) .....

(vii) .....

(viii) .....

- Virtual storefront

i. Content provider
ii. Virtual community
iii. Online marketplace
iv. Brick and click
v. Information broker
vi. Reverse auction
vii. Group purchasing

[Note: correct key words(exact) should be written from the given list]

[any 1 correct = 1 mark
Any 2 correct = 2 marks
Any 3 correct = 3 marks
Any 4 correct = 4 marks
Any 5 correct = 4.5 mark
Any 6 correct = 5 marks
Any 7 correct = 5.5 marks
All 8 correct = 6 marks

{Total for 2 (a) = 6 marks}

(b) (i) Write down the two's complement representation of 12_{10} using 8 bits.

00001100

[1 mark]

(ii) Write down the two's complement representation of -68_{10} using 8 bits.

68 -> 01000100
Complement of (68) -> 10111011
-68 -> 10111100

[final answer 1 mark,
if only first two steps are correct and answer incorrect 0.5
maximum mark 1]

(iii) Compute $-68_{10} + 12_{10}$ using the above representations (i) and (ii).

```
  10111100
+ 00001100
----------
  11001000
```

[1 mark,
No partial Marks]

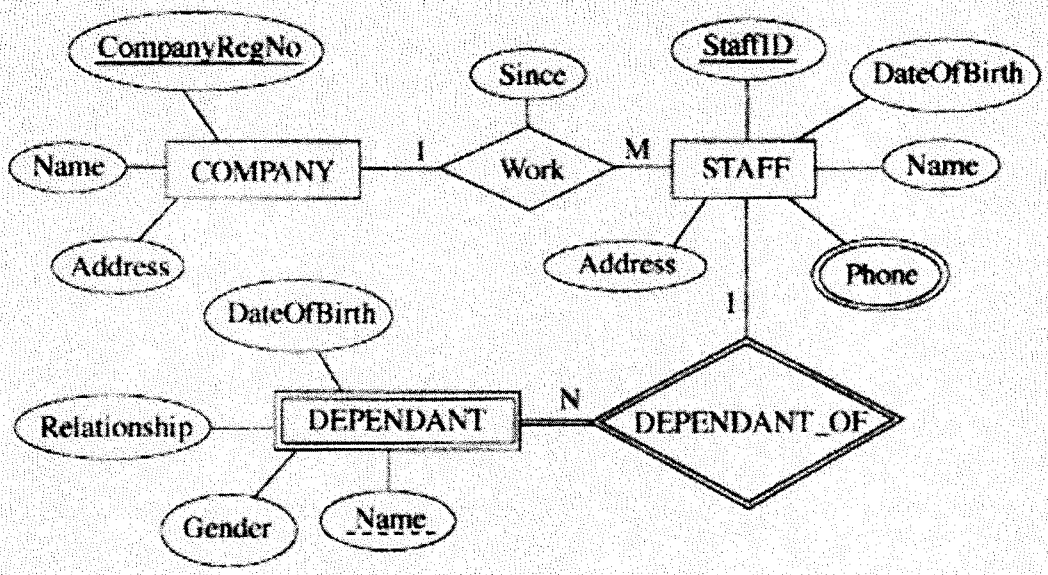
(iv) State **one** advantage of using two's complement representation for data in internal operations of a computer.

- More efficient calculations
- Possible to represent negative number
- Subtractions are carried out as additions
- A single representation is used to represent '0'

[1 mark]
{Total for 2 (b) = 4 mark}

[TOTAL MARKS FOR Q2 10 MARKS]

3. (a) Consider the following Entity Relationship (ER) diagram:



(i) Briefly explain why the 'Phone' attribute is shown using a different symbol compared to other attributes.

"Phone" – is a multivalued attribute / attribute can have multiple values and other attributes have only single values

[1 mark]

(ii) Briefly explain why DEPENDANT entity is shown using a different symbol compared to COMPANY.

"DEPENDENT" is a weak entity / can not be uniquely identified by its attributes alone or equivalent meaning

[1 mark]

(iii) The following relational tables are constructed using the ER diagram shown above. In each of the tables, the field names are missing.

COMPANY (.....Ⓟ.....)
STAFF (.....Ⓠ.....)
STAFF_PHONE (.....Ⓡ.....)
DEPENDANT (.....Ⓢ.....)

Identify the missing field names in each table and write them down against Ⓟ - Ⓢ.

Ⓟ - .....

Ⓠ - .....

Ⓡ - .....

Ⓢ - .....

P -> CompanyRegNo, Name, Address

Q -> StaffID, CompanyRegNo, Name, Address, DateOfBirth, Since

or

Q -> StaffID, CompanyRegNo, Name, Address, DateOfBirth

R -> StaffID, Phone

S -> StaffID, Name, Relationship, Gender, DateOfBirth

[If any additional fields mentioned or fields missing or incorrect field names written: no marks awarded

Each correct 0.5 x 4 =2 marks,

[Note: Overall completeness mark of 0.5 for part iii not awarded if 'Since' missing, however 0.5 awarded for other five fields in Q]

for overall completeness (properly underlines key fields, 'Since' field included in Q, attribute names correctly written in correct upper-lower case with spellings, and All P-S correct + 0.5

Total = 2.5 marks]

(iv) Write an SQL statement to display *Names* and *Addresses* of all the STAFF.

```
Select Name, Address from STAFF;
```

[1 mark,

no partial marks,

Incorrect field names no marks]

(v) Write an SQL statement to display the names of the dependants of staff member with StaffID = 'E001124'.

```
Select Name from DEPENDANT where StaffID ='E001124' ;
    Or
Select Name from DEPENDANT where StaffID like '*E001124*'
```

[String has be within double or single quotes

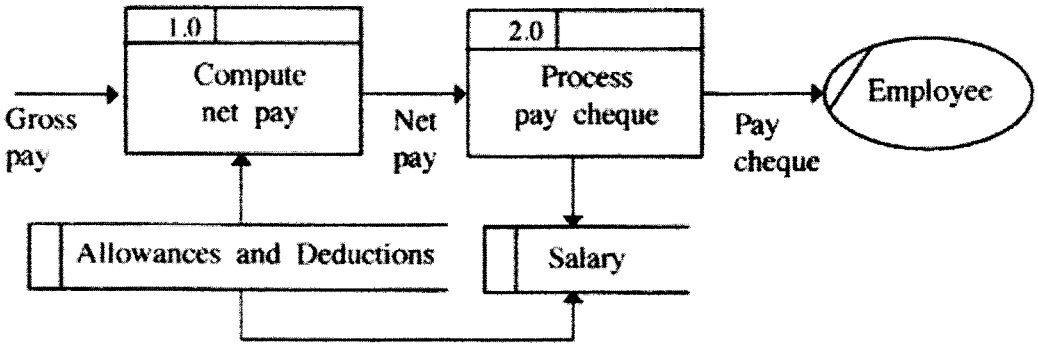
No partial marks

Incorrect field names no marks]

1 mark]

{Total for 3(a) = 6.5 marks}

(b) (i) Identify and explain the fundamental error in the following Data Flow Diagram (DFD).



There cannot be a Data Flow from one Datastore to another Datastore without a process directly

[1 mark

if more than one answer given as the fundamental error = no marks]

(ii) Write down whether each of the following statements regarding software agents is either True or False.

		True/False
(1)	A software agent can perform tasks in achieving a goal with minimum or no direct supervision.	.....
(2)	Software applications can interact with agent without direct supervision of a user.	.....
(3)	A user may obtain answers to a problem directly from an agent.	.....
(4)	A multi-agent system is a network of problem-solving entities called agents that work together to find answers to problems that are beyond the individual abilities of each agent.	.....
(5)	In a multi-agent system, individual agents may compete or co-operate to achieve the system goals.	.....

1. True
2. True
3. True
4. True
5. True

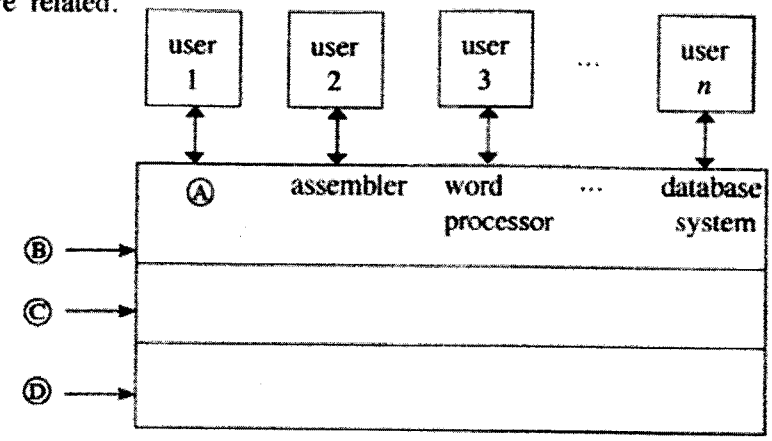
[0.5 x 5 marks

Total = 2.5 marks]

{Total for 3(b) = 3.5 marks}

[TOTAL MARKS FOR Q3 10 MARKS]

4. (a) Consider the following diagram which shows how the abstract layers of a computer system are related.



Choose and write down the correct terms from the list given below for labels Ⓐ, Ⓑ, Ⓒ and Ⓓ.

List = {*compiler, computer hardware, live-ware, operating system, system /application programs*}

Ⓐ .....

Ⓑ .....

Ⓒ .....

Ⓓ .....

A -> Compiler

B -> System/Application programs

C -> Operating System

D -> Computer Hardware

[1 correct (with others blank) 0.5 marks,
2 correct (with others blank) 1 marks,
3 correct (with others blank) 1.5 marks,
All correct= 2 mark]

(b) Order **four** of the following statements in the correct sequence to describe the operations that take place when a computer is switched on.

(**Note:** Two of the statements will **not** be needed.)

A - The BIOS copies Operating System (OS) files into memory and the OS starts executing.

B - The BIOS looks to the CMOS chip to tell it where to find the OS.

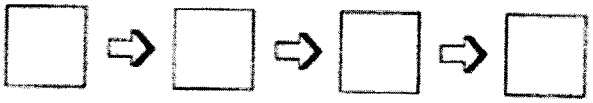
C - The compiler is started.

D - The contents in memory is swapped to the hard disk.

E - The OS loads the device drivers that it needs to control the devices and gives a login interface to the user.

F - Triggered by a series of clock ticks, the CPU executes the startup program's instructions in the BIOS that involves the power on self-test.

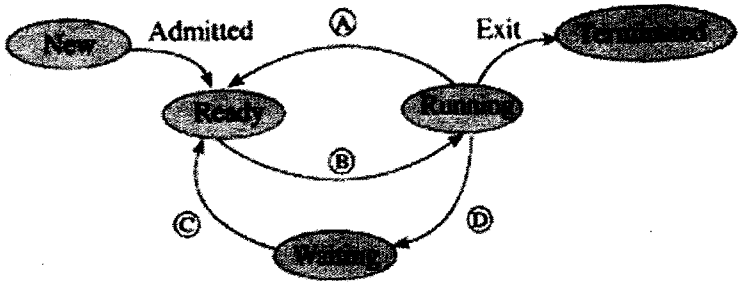
The sequence of operations is: (fill in the boxes with relevant letters)



F -> B -> A -> E

[All correct= 2 marks
No partial marks]

(c) The state transitions that could occur in a process running on a computer with a **multi-tasking** operating system is shown in the following diagram:



(i) Choose and write down the transition triggers indicated by the labels Ⓐ, Ⓑ, Ⓒ and Ⓓ from the list given.

List = {*interrupt, Input/Output (I/O) or event completion, I/O or event wait, scheduler dispatch*}

Ⓐ ..... Ⓑ .....

Ⓒ ..... Ⓓ .....

{note: question number (i) is missing in the Sinhala paper}

A – Interrupt
B -> Scheduler dispatch
C -> I/O or event completion
D -> I/O or event wait

[Each correct 0.5 x 4= 2 marks
Total = 2 marks]

(ii) For the process above, give **one** possible reason for the following transition trigger:

interrupt : .....

.....

OS decides to let another task run / process time out / a higher priority process comes

[1 mark]

{Total for 4 (c) = 3 marks}

(d) In a certain computer, the physical memory has a total capacity of 4 GB. The size of a memory frame is 4 KB.

(i) Compute the total number of frames in the physical memory.

4 x 1024 x 1024 /4 frames

or
1048576 frames
or
$2^{10} \times 2^{10}$ frames
Or
2^{20} frames

['frames' word' optional in answer, 1 mark]

(ii) The operating system maintains a data structure named the *page table* in respect of each process running in the computer. For what purpose is it used?

This data structure holds the mapping between process pages and memory frames

[1 mark]

(iii) With respect to the physical memory size, what is the benefit of using the technique of virtual memory in the above computer?

The virtual memory technology makes it possible to use programs which are larger than the size of the physical memory (4GB)

[1 mark]
{Total for 4 (d) = 3 marks}
[TOTAL MARKS FOR Q4 10 MARKS]

****Important****

Information for Chief Examiners of the panels: Please fill the following table and include any amendments made at the chief controllers meeting held on 9th September.

Check List

Question	Amended? ✓	Amendment Made
1. (a) (i) (1)	☐	
(2)	☐	
(ii)	☐	
(iii)	☐	
(b)	☐	
(c)	☐	
2 (a)	☐	
(b) (i)	☐	
(ii)	☐	
(iii)	☐	
(iv)	☐	
3 (a) (i)	☐	
(ii)	☐	

(iii)	☐	
(iv)	☐	
(v)	☐	
(b) (i)	☐	
(ii)	☐	
4 (a)	☐	
(b)	☐	
(c) (i)	☐	
(ii)	☐	
(d) (i)	☐	
(ii)	☐	
(iii)	☐	

****

Information and Communication Technology 20/E/II (English) -2018

Marking Scheme

Part B

Special Notes:

i. .../.../... indicate only one of the options included are considered as one answer

ii. Underlined key words or synonyms are mandatory in a given answer

iii. [..] {} indicates marking guidelines

iv. If any amendments are made during 9th September 2018 meeting such changes need to be correctly written in the cages provided on page 46 - 47 and verified with the panel/chief examiners by the individual examiner.

Answers & Marking Guide:

1. Suppose a logic circuit needs to be implemented for a digital system that has three inputs A, B and C and one output Z. Its behaviour is as follows:

If the input C=1, the output Z has the value of A.

If the input C=0, then output Z has the value of B.

(a) Obtain the truth table for the output Z.

Truth table for the output Z Truth Table

A	B	C	Z
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

[0.5 marks X 8

= 4 marks]

(b) Write down either a sum of products (SOP) or a product of sums (POS) Boolean expression for Z.

Option 1: Sum of products (SOP)

Using the 1-rows for Z, $Z = \bar{A}\,B\,\bar{C} + A\,\bar{B}\,C + A\,B\,\bar{C} + A\,B\,C$

"Z = " optional

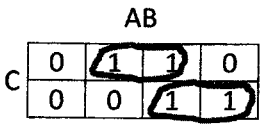
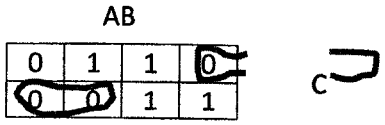
Option 2: Product of sums (POS)

Using the 0-rows for Z, $Z = (A + B + C)(A + B + \bar{C})(A + \bar{B} + \bar{C})(\bar{A} + B + C)$

[2 marks]
[No partial marks]

(c) Simplify the Boolean expression for Z obtained in (b) above.

Method 1: Using Karnaugh map

Option 1: Start from SOP		**Option 2**: Start from POS
		
Simplified SOP: $Z = A\,C + B\,\bar{C}$		Simplified POS: $Z = (A + \bar{C})\,(B + C)$
Steps: • Correct Karnaugh map → 1 mark • Correct marking of two groups (loops)→ 1 mark each *2 → 2 marks **[3 marks]** Expected final answer: $Z = A\,C + B\,\bar{C}$ **[2 marks]** **[total for (c): 5 marks]**		Steps: • Correct Karnaugh map → 1 mark • Correct marking of two groups (loops)→ 1 mark each *2 → 2 marks **[3 marks]** Expected final answer: $Z = (A + \bar{C})\,(B + C)$ **[2 marks]** **[total for (c): 5 marks]**

Method 2: Using Boolean algebra

Option 1: Start from SOP

$Z = \bar{A}\,B\,\bar{C} + A\,\bar{B}\,C + A\,B\,\bar{C} + A\,B\,C$

$Z = A\,B\,C + A\,\bar{B}\,C + \bar{A}\,B\,\bar{C} + A\,B\,\bar{C}$

$Z = A\,C(B + \bar{B}) + B\,\bar{C}(\bar{A} + A)$ ← 1 mark each for factorizing *2 = **[2 marks]**

$Z = A\,C(1) + B\,\bar{C}(1)$ ← 0.5 each for simplification * 2 = **[1 mark]**

$Z = A\,C + B\,\bar{C}$ ← Expected final answer **[2 marks]**

Option 2: Start from POS

$Z = (A + B + C)(A + B + \bar{C})(A + \bar{B} + \bar{C})(\bar{A} + B + C)$

$Z = (A + B + \bar{C})(A + \bar{B} + \bar{C})(A + B + C)(\bar{A} + B + C)$

$Z = (A + \bar{C})(B + \bar{B}) + (B + C)(A + \bar{A})$ ← 1 mark each for factorizing *2 = **[2 marks]**

$Z = (A + \bar{C})(1) + (B + C)(1)$ ← 0.5 each for simplification * 2 = **[1 mark]**

$Z = (A + \bar{C})\,(B + C)$ ← Expected final answer **[2 marks]**

[Steps 3 marks + final answer 2 marks,

= total 5 marks

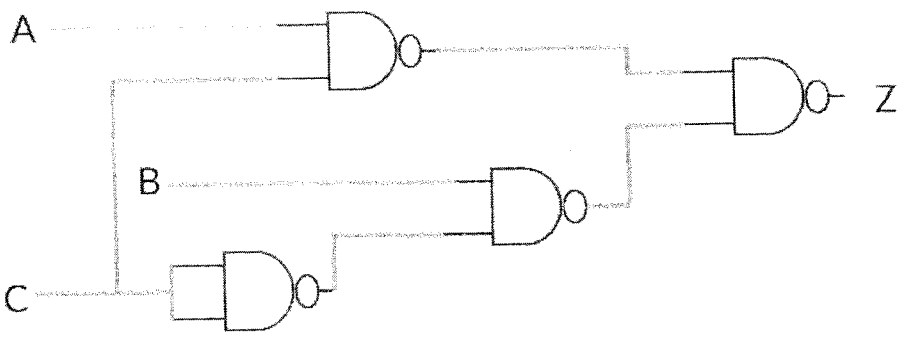
{Total for 1 (c): 5 marks}

(d) Using the simplified expression in (c) above, construct a logic circuit for the system using **either** 2-input NAND gates only **or** 2-input NOR gates only.

Logic circuit

Option 1: Using 2-input logic NAND gates only

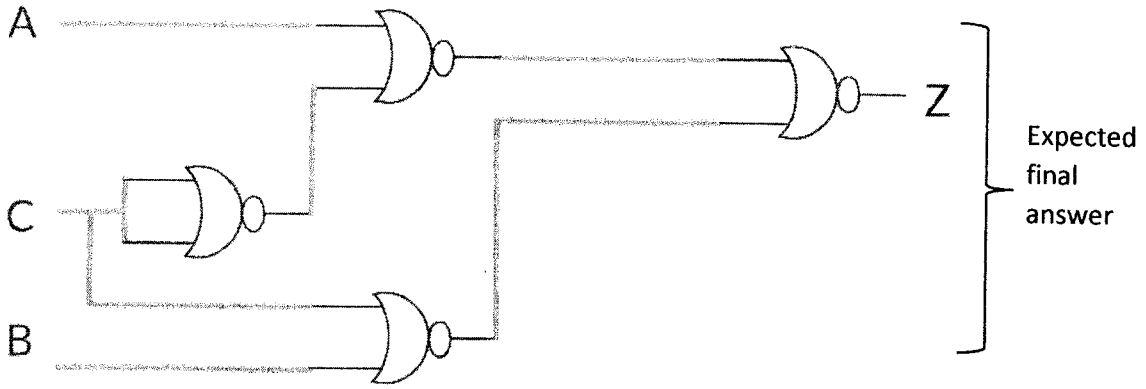
Can start from the simplified SOP expression, obtain AND-OR sequence, then convert that into NAND-NAND using De-Morgan's Law



Expected final answer

Option 2: Using 2-input NOR gate only

Can start from the simplified POS expression, obtain OR-AND sequence, then convert that into NOR-NOR using De-Morgan's Law



[4 marks]

{0 marks if even a single disallowed gate is used

2 marks if the number of NAND /NOR gates is higher than above, due to not utilizing De Morgan's Law, but the circuit correctly implements the logic function for Z

-1 for each input or output not clearly and correctly labelled in the diagram (e.g., 3 out of 4 marks if the output is not labelled as Z; 0 out of 4 marks, if none of the 3 inputs and the output are labelled).}

[TOTAL FOR Q1 15 MARKS]

2. Consider the following scenario.

The XYZ company has six departments, namely *Production*, *Accounts*, *Sales*, *Administration*, *Maintenance* and *Information Technology Services* (*IT*). The following table shows the number of computers available in each of the departments.

Department No.	*Department*	*Number of Computers*
D01	Production	25
D02	Accounts	30
D03	Sales	18
D04	Administration	30
D05	Maintenance	25
D06	IT Services	28

Each department needs to have their own local area network. Network administrator has received a class C IP address block 192.248.154.0/24. It is required to subnet the IP address block to satisfy the requirements of each department and allocate IP addresses to them.

(a) (i) How many addresses are available in the IP address block?

256 addresses

[1 mark]

(ii) What are the first and the last addresses of the IP address block?

First address: 192.248.154.0, Last address: 192.248.154.255

[1 mark x 2 = 2 marks]

(iii) How many host bits are required to create the required subnets?

Three (03) host bits are required

[1 mark]

(iv) After subnetting, write the relevant network address, subnet mask and allocated range of IP addresses for each department.

Note: Use the following table format to present your answer.

Department No	*Network Address*	*Subnet Mask*	*IP Address Range*
D01			
D02			
D03			
D04			
D05			
D06			

Department No	Network Address	Subnet Mask	IP Address Range
D01	192.248.154.0	255.255.255.224	**192.248.154.0 – 192.248.154.31** **192.248.154.1 - 192.248.154.30**
D02	192.248.154.32	255.255.255.224	**192.248.154.32 – 192.248.154.63** **192.248.154.33- 192.248.154.62**
D03	192.248.154.64	255.255.255.224	**192.248.154.64 – 192.248.154.95** **192.248.154.65 - 192.248.154.94**
D04	192.248.154.96	255.255.255.224	**192.248.154.96 – 192.248.154.127** **192.248.154.97 - 192.248.154.126**
D05	192.248.154.128	255.255.255.224	**192.248.154.128 – 192.248.154.159**

			192.248.154.129 - 192.248.154.158
D06	192.248.154.160	255.255.255.224	**192.248.154.160 – 192.248.154.191** **192.248.154.161 - 192.248.154.190**

[Each correct row 0.5 marks,

0.5 x 6 marks

= 3 Marks]

Two other possible entries for any of the department:

Network Address	Subnet Mask	IP Address Range
192.248.154.192	255.255.255.224	**192.248.154.192 - 192.248.154.223** **193.248.154.193 - 192.248.154.222**
192.248.154.224	255.255.255.224	**192.248.154.224 – 192.248.154.255** **192.248.154.225 - 192.248.154.254**

Alternative Solutions:

- **First divide (subnet) the IP address block into four equal subnets with 64 addresses of each**
- **Allocate first two subnets (blocks) to two separate departments**
- **Get third block and divide into two equal subnets of size 32 and allocate to two other departments**
- **Get the last block of 64 address and divide into two equal subnets of size 32 addresses and allocate to the two remaining department.**

Department No	Network Address	Subnet Mask	IP Address Range
D01	192.248.154.0	255.255.255.192	**192.248.154.0 – 192.248.154.63** **192.248.154.1 - 192.248.154.62**
D02	192.248.154.64	255.255.255.192	**192.248.154.64 – 192.248.154.127** **192.248.154.65- 192.248.154.126**

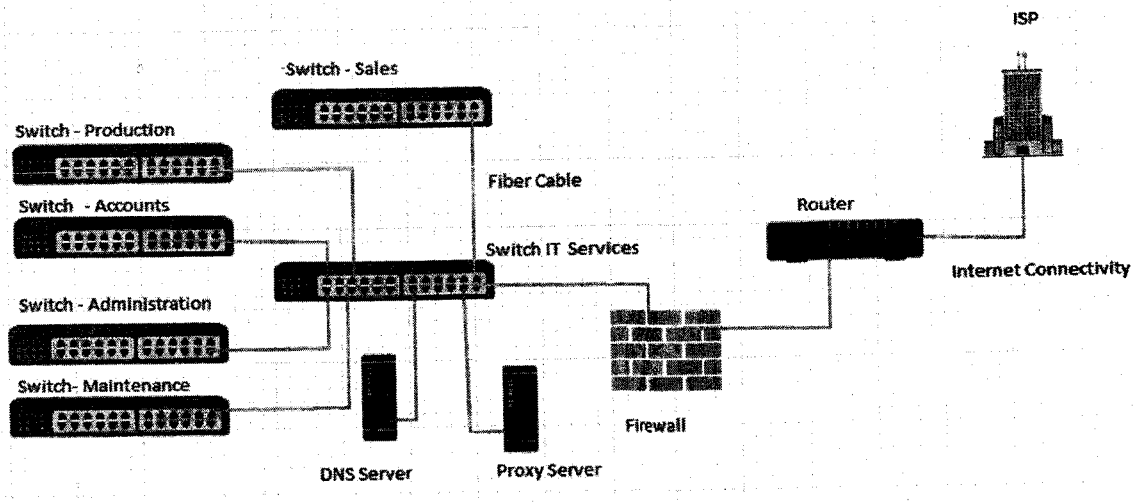
D03	192.248.154.128	255.255.255.224	**192.248.154.128 – 192.248.154.159** **192.248.154.129 - 192.248.154.158**
D04	192.248.154.160	255.255.255.224	**192.248.154.160 – 192.248.154.191** **192.248.154.161 - 192.248.154.190**
D05	192.248.154.192	255.255.255.224	**192.248.154.192 - 192.248.154.223** **193.248.154.193 - 192.248.154.222**
D06	192.248.154.224	255.255.255.224	**192.248.154.224 – 192.248.154.255** **192.248.154.225 - 192.248.154.254**

(b) The XYZ Company links the five departments Production, Accounts, Sales, Administration and Maintenance to the IT Services department and connects those departments to the Internet through the IT Services department. The network has been completed by laying the cables and installing six switches, a router and a firewall. All six departments are situated in six separate buildings.

The administrator allows all subnets to access the Internet through a proxy server. The proxy server and the DNS server are located in the IT Services department.

Draw the labelled network diagram to show the logical arrangement of the computer network of the XYZ company by identifying suitable devices and required cables for all the locations.

Network diagram

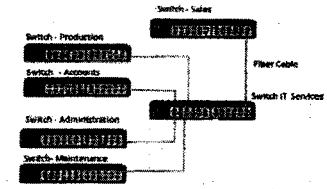


- Placing switches correctly and labeling.

[2 marks]

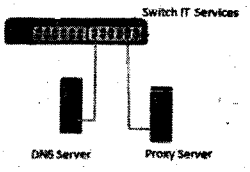
- Connecting switches with cables and naming correctly

- **[0.5 + 0.5 marks]**



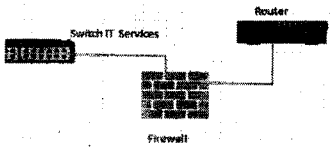
- Placing DNS server and Proxy server in the correct place

- **[1 mark]**



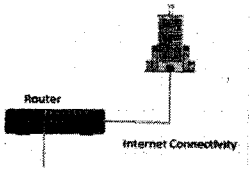
- Placing router and firewall in the correct place and connecting them

- **[1 mark]**



- **Showing the connection to the Internet**

[1 mark]



(c) After setting up the network any employee of any department was able to access the URL http://www.nie.lk through a web browser in a computer in his/her department. However, one day an employee finds that he cannot access that website from a computer in his department. Write three possible reasons for the above problem.

- o DNS is not working (down)
- o Proxy Server down
- o Change the proxy settings
- o Internet Link is not working (down)
- o Switch is broken / No power for the switch
- o Router is not working
- o Cable damage / Cables not properly connected
- o Network card of the computer is not working
- o Computer is not properly connected to the network
- o TCP/IP configuration of the machine is wrong
- o NIE Server down

[1 correct = 1 mark
2 correct = 1.5 marks
3 correct = 2 marks
[TOTAL FOR Q2 15 MARKS]

3. (a) A business sells handicraft items such as wooden masks, handmade souvenirs, and batik and handloom cloths for tourists in a certain city of Sri Lanka. At present customers walk to the shop and buy goods with cash. The owner plans to start selling his products online through his own web portal.

(i) State the type of e-business model the owner plans to start.

B2C/Business to Consumer/Business to Customer

[1 mark]

(ii) Assume that a certain tourist hotel situated nearby is willing to publicize the planned online shop in their hotel web site.

(1) What type of e-business model can be established in the above scenario between the handicraft business and the hotel?

B2B/Business to Business

[1 mark]

(2) Briefly explain **one** possible e-business revenue model **each**, for the hotel and the proposed online shop of the handicraft business.

Hotel: Hotel can earn revenue by displaying handy craft business's advertisement on their web site and channeling traffic to the handicraft business site.
(Advertising/affiliate revenue model)

[1 mark]

Handicraft Business: Proposed e-business portal can earn revenue by sale of products.

(Sales revenue model)

[1 mark]

(iii) State **two** methods that can be used by the planned e-business for processing online payments.

Payment gateways (using credit cards/debit cards/using electronic payment cards online) /third party electronic payment processors such as PayPal/online fund transfer/using online banking fund transfer, can be used to process electronic payments via e-business portal.

[2 marks]

(iv) Briefly explain **one** e-marketing method that you would propose to attract customers to the planned e-business web portal.

Social media campaign (via Facebook, Twitter etc.)/ email campaign (direct mailing)/SMS campaign/advertising in other websites can be used to attract users to the proposed site/ Search Engine Marketing

[Correct method 1 mark, explanation 1 mark

=2 marks]

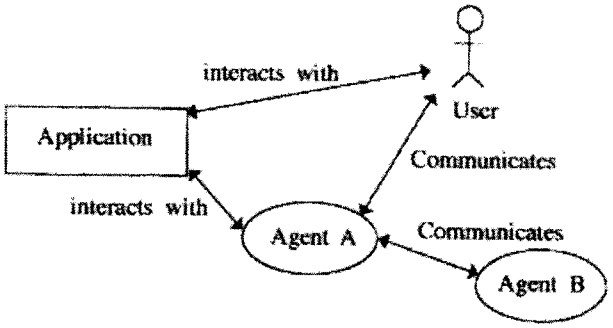
(v) Explain how the user experience can be improved using intelligent agent technology in the planned e-business web portal

Intelligent agent technology can be used to suggest customer preferred products by analyzing customer behavior on site/ intelligent search functions can be provided to help user search through the products/for product recommendations on the site

[Keyword 1 mark, proper explanation 2 mark}

[3 marks]

(b) Consider the following figure which shows a simplified view of a multi-agent system.



Answer the following question by studying the above figure.

"*A software agent may or may not have a user interface*".
Do you agree with the above statement? State a reason referring to the above figure.

Yes,

[1 mark]

as illustrated in the diagram an agent software has the ability to communicate with the user via the user interface (agent A and User)as well as the other agents as well as the in a multi-agent environment(agent A and Agent B without user interaction (self-autonomous)).

[Agent user communication - 1.5, agent -agent communication 1.5

= 3 marks]

{Total for 3(b) = 4 marks}

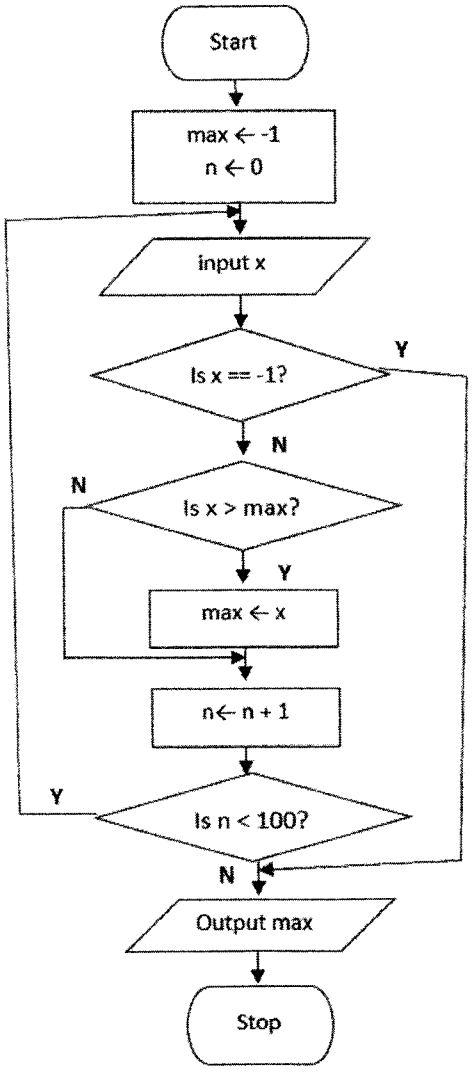
[TOTAL FOR Q3 15 MARKS]

4. (a) Assume an input which contains a sequence of positive numbers. The sequence has at most 100 numbers. If the input sequence has n numbers where n < 100, then the end of the sequence is marked by making $(n+1)^{th}$ number –1.

For e.g., the following input sequence has 8 positive numbers, where the 9^{th} input which is –1 marks the end.

23 12 54 76 89 22 44 65 –1

Draw a flowchart that represents an algorithm to output the largest number in a given sequence of *n* positive numbers as described above.



[Marks breakdown:

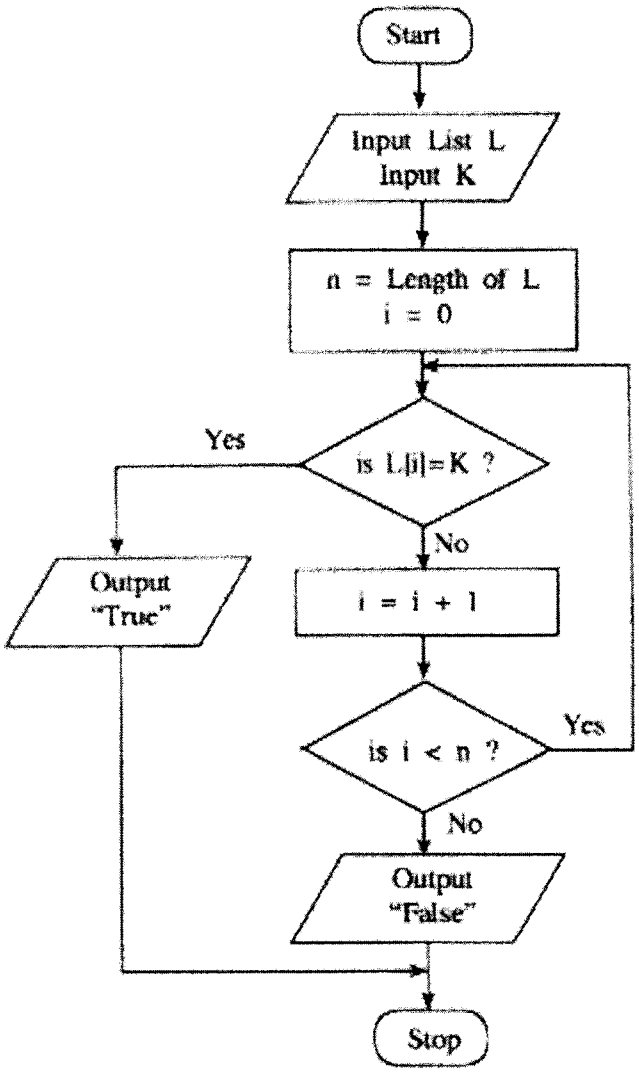
Correctness of overall algorithm: 1 mark

3 decision elements must exist: 3 marks for correct use of them, as follows (or equivalent):

- **"is x == -1?" → 1 mark (including correct Y and N connections)**
- **"is x > max?" → 1 mark (including correct Y and N connections)**
- **"is n < 100?" → 1 mark (including correct looping / Y and N connections)**

Correct initialization of variables: 1 mark
Correct update of max: 1 mark
Correct input and output: 0.5 marks
"start" and "stop": 0.5 marks
Penalties applied after the above mark allocation:
if wrong flowchart symbols used, -1 for each wrong symbol]
{Total for part (a) 7 marks}

(b) Consider the flowchart given below. The algorithm in the flowchart takes two inputs, the first input L is a list of numbers, the second input K is a given number.



(i) What would be the output if the first input L was 23, 45, 32, 11, 67, 39, 92, 51, 74, 89 and the second input K was 38?

False

[1 mark]

(ii) Briefly explain the aim of this algorithm.

Determine if K is in L / output True if K is in L, False otherwise

[2 marks

No partial marks]

(iii) Develop a Python program to implement the algorithm in the flowchart.

Python program to implement the algorithm expressed by the flowchart.

```
# ListSearch.py(Python version 3.x program)
# input: L (a list of numbers), K (a number)
# output: "True" if K is in L, "False" otherwise
L = input("Enter the list of numbers:")
numList = [int(i) for i in L.split()] # or similar way
K = int(input("Enter K, item to search:"))
n = len(numList)
i = 0
while i < n:
    if (numList[i] == K):
        print("True")
        break
    i = i+1
if (not (i < n)):
    print("False")
```

[Loop must exist with correct looping and exiting/aborting of loop → 1 mark

"if" must exist to compare each list element with K → 1 mark

Correct method to get input → 1 mark

Correct method to output → 1 mark

Overall correctness → 1 mark

Minor syntax errors will be ignored (not penalized)

Colon ":" and indentation are major (not minor) syntax]

[Total = 5 marks]

{Total for 4(b) 8 marks}

[TOTAL FOR Q4 15 MARKS]

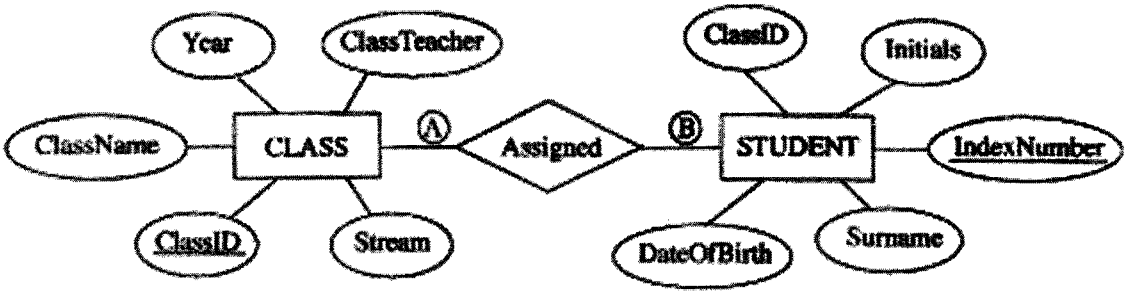
5. The following two tables CLASS and STUDENT are constructed by using the Entity Relationship (ER) diagram shown in Figure.

CLASS Table

ClassID	ClassName	ClassTeacher	Stream	Year
1111	12 - A	A. B. Perera	Physical Science	2017
1112	12 - B	N. Mohamed	Bio Science	2017
1113	13 - A	E. Selvadurai	Arts	2017
1114	13 - B	L. De Silva	Commerce	2018

STUDENT Table

IndexNumber	ClassID	Initials	Surname	DateOfBirth
8991	1112	E.	Nazeer	1999.12.06
8993	1111	S.	Sivalingam	1999.02.06
8995	1112	W.	Fernando	1999.11.11
8997	1113	U. H.	De Silva	1999.08.06



(a) What is the cardinality of the relationship between the entities STUDENT and CLASS, denoted by Ⓐ and Ⓑ above? Note: Write down suitable labels for Ⓐ and Ⓑ, respectively.

A= 1, B=N (M) / one to many / 1: n/1:N

[A, B labels optional; order mandatory

[1 mark X 2

= 2 marks]

(b) Explain how a relationship is established between the two tables using primary key(s) and foreign key(s) in the above example.

Primary key ClassID of CLASS table is used as the foreign key in STUDENT table.

[2 marks No partial marks]

(c) (i) Are the two tables STUDENT and CLASS, in second normal form (2NF)? Explain a reason for your answer referring to tables.

Yes,

[1 mark]

Both STUDENT and CLASS table are in 1NF as all fields are atomic and every non-prime attribute of each relation is fully functionally dependent on the primary key / primary key is not composite, hence all other attributes are fully functionally dependent on the primary key, and there are no partial dependencies / they are in 3NF as no transitive dependencies exists in addition to primary non composite primary key, hence in 2NF

{Identifying the keywords 2 marks

or

Complete explanation 3 marks

[4 marks]

(ii) Briefly explain **one** key advantage of *normalisation*.

- Data integrity and consistency is maintained hence database is (Atomicity, Consistency, Isolation, Durability) ACID compliant
- no data duplication/ there is less chance of storing two or more different copies of the data/Smaller size database (By eliminating duplicate data, you will be able to reduce the overall size of the database
- Data integrity/no update, delete, insert anomalies/Data modification anomalies are reduced.
- Better performance faster access speed/ fewer indexes per table mean faster maintenance tasks such as index rebuilds/ Searching, sorting, and creating indexes is faster, since tables are narrower, and more rows fit on a data page
- Conceptually cleaner and easier to maintain and change database
- Updates run quickly due to no data being duplicated in multiple locations.
- Inserts run quickly since there is only a single insertion point for a piece of data and no duplication is required.
- Tables are usually smaller that the tables found in non-normalized databases. This usually allows the tables to fit into the buffer, thus offering faster performance.

[3 marks]

{Total for 5(b) 7 marks}

(d) Write an SQL statement to insert the following record to the CLASS table:

1115	13 - C	A.B. Jinasena	Technology	2018

INSERT INTO CLASS VALUES (1115, '13 – C', 'A.B. Jinasena', 'Technology', 2018);

or

INSERT INTO CLASS VALUES ('1115', '13 – C', 'A.B. Jinasena', 'Technology', '2018');

or

INSERT INTO CLASS (ClassID, ClassName, ClassTeacher, Stream, Year) VALUES ('1115', '13 – C', 'A.B. Jinasena', 'Technology', '2018');

or

INSERT INTO CLASS (ClassID, ClassName, ClassTeacher, Stream, Year) VALUES (1115, '13 – C', 'A.B. Jinasena', 'Technology', 2018);

[Statement structure correct (Correct keywords + correct field names + correct values)

2 marks;

Overall completeness (Correct keywords + correct field names + correct values+ correct use of quotes (either ' or ")+ semicolon(Exact Answer)) + 2 mark]

no other forms of partial marks

=total 4 marks]

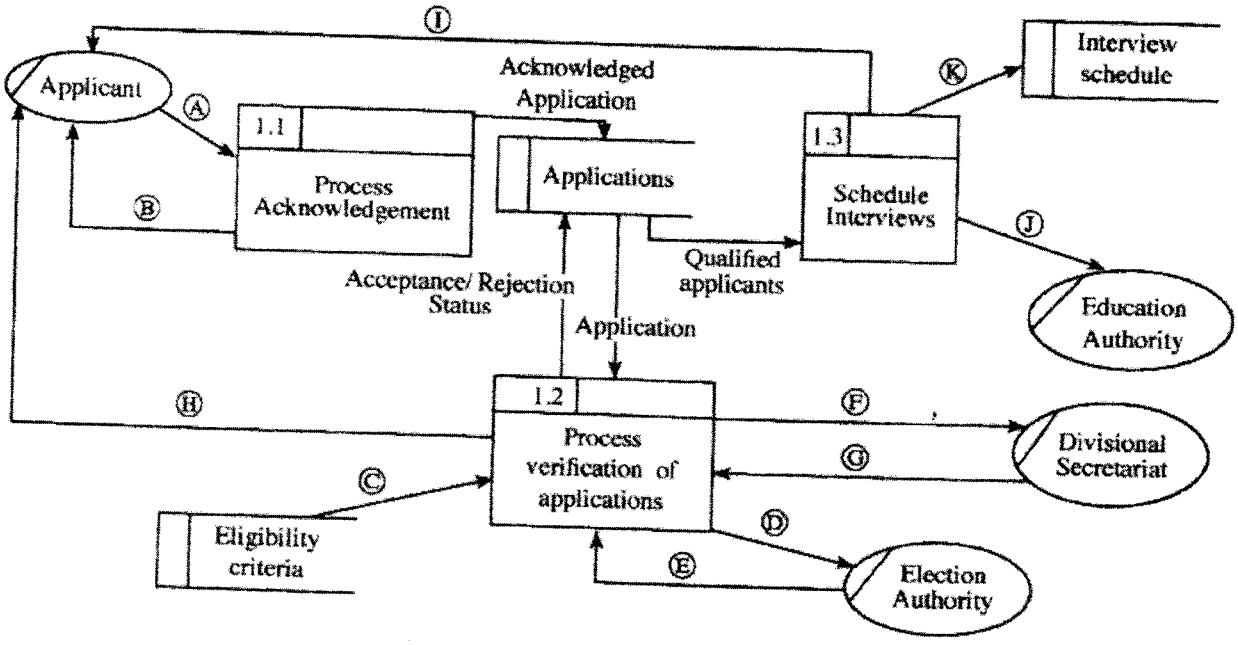
[TOTAL FOR Q3 15 MARKS]

6. (a) The school admission process of a certain country is explained using the description and the data flow diagram given below.

The applicant sends the application to the respective school. The school sends an acknowledgement to the applicant. The school then verifies the information in the application by checking the following.

- Eligibility of applicant : by using the eligibility criteria taken from the data store '*Eligibility Criteria*'
- Registration in the electorate : by requesting the electoral list from the Election Authority (Election Authority sends the Electoral list to the school)
- Residential status : by requesting the confirmation of residence from the Divisional Secretariat (Divisional Secretariat sends the confirmation of residence to the school)

After verification of information, the applicant is informed whether the application has been accepted or rejected which is noted in the application and stored in the data store "Applications". The school obtains the valid applications from the data store "Applications" and schedules the qualified applicants for interviews. Then it calls the applicants for interviews and sends the interview schedule to the Education Authority. The interview schedule is stored in the data store "Interview Schedule".



Level 1 DFD

The *Level 1* Data Flow Diagram for the above scenario with some data flows labelled as Ⓐ - Ⓚ is given in figure. Identify and write down the relevant data flows against the labels Ⓐ - Ⓚ.

A- Application,

B- Application Acknowledgement/Acknowledgement

C-Eligibility Criteria

D-Request/Application for Electoral List

E- Electoral List

F- Request/Application for Residential Status/Confirmation of Residence

G- Residential Status/Confirmation of Residence

H- Acceptance/Rejection Status

I- Interview Letter/Interview Date, Time (Venue)

K- Interview Schedule

J -Interview Schedule

[Each correct ½ mark = 5 ½

+ ½ for completeness (all 11 are correct)

= 6 marks]

(b) (i) Briefly explain the key difference between functional and non-functional requirements as used in the system development life cycle.

- Functional requirements : Any requirement which specifies what the system should do or provide for users/ they related to the technical functionality of the system./ function is described as a specification of behavior between outputs and inputs/ behavior (output) that a device or software is expected to exhibit in the case of a certain input./ desired operations of a software, or system
- Non-functional requirements : Any requirement which specifies how the system performs a certain function or system works /They describe how, how well or to what standard a function should be provided /nonfunctional requirements describe the general characteristics of a system. They are also known as *quality attributes*. (Include service hours, service availability, responsiveness, throughput and reliability.)/define system attributes such as security, reliability, performance, maintainability, scalability, and usability

[2 *2 marks = 4 marks,
No partial marks less than 2 marks,
Total= 4 marks]

(ii) The following list includes some functional and non-functional requirements of a proposed e-commerce web portal that plans to sell products on a catalogue:

A – Enable user to find products based on a variety of item characteristics

B – The system should work on any web browser

C – The system should be easy to use

D – Enable user to submit his/her comments on products and read other users' comments on items

E – Data in the system should be preserved even in the case of a system failure

F – Enable user to create and maintain a wish list of desired products

G – Enable user to browse through products on catalogue

H – The system should be available for use 24 hours a day, 7 days a week and 365 days an year

I – The system should authenticate users through usernames and passwords

J – The system should have versions customized for global users, e.g., French, Japanese, German, etc.

Identify and write down the labels of the **non-functional** requirements in Ⓐ - Ⓙ.

Nonfunctional requirements
B,C,E,H,J

[Each correct 1 mark,

Each incorrect answer reduce 1 mark,
All written 0 marks

More incorrect answers than correct answers 0 marks

Total = 5 marks]

{Total for 6(b) 9 marks}

[TOTAL FOR Q6 15 MARKS]

****Important****

Information for Chief Examiners of the panels: Please fill the following table and include any amendments made at the chief controllers meeting held on 9th September.

Check List

Question	Amended? ✓	Amendment Made
1. (a)	☐	
(b)	☐	
(c)	☐	
(d)	☐	
2 (a) (i)	☐	
(ii)	☐	
(iii)	☐	
(iv)	☐	
(b)		
(c)		
3 (a) (i)	☐	
(ii)	☐	
(iii)	☐	

(iv)	□	
(v)	□	
(b)	□	
4 (a)	□	
(b) (i)	□	
(ii)	□	
(iii)	□	
5. (a)	□	
(b)	□	
(c) (i)	□	
(ii)	□	
(d)	□	
6. (a)	□	
(b) (i)	□	
(ii)	□	

****