Total No. of Questions : 4]

SEAT No. :

P9032

[Total No. of Pages : 1

Oct-22/TE/Insem - 564
T.E. (Information Technology)
INTERNET OF THINGS
(2019 Pattern) (Semester - I) (Elective - I) (314445 D)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Define IoT and explain physical design of IoT. **[7]**

b) Explain IoT world Forum (IoTWF) standardized seven-layer IoT architectural reference model. **[8]**

OR

Q2) a) Explain enabling technologies in IoT. **[7]**

b) Write a short note on (Any Two): **[8]**

i) Software defined Networking
ii) Network function virtualization
iii) Wireless Sensor Networks

Q3) a) Define Sensor and explain types of sensors with examples. **[7]**

b) Write a short note on (Any Two): **[8]**

i) 12C bus protocol
ii) CAN bus protocol
iii) UART
iv) USRT

OR

Q4) a) Draw and explain interfacing of LED with ARDIUNO with program to blink it. **[7]**

b) Draw and explain interfacing of DC motor with ARDIUNO with program of speed control. **[8]**

Total No. of Questions : 8]

SEAT No. :

PA-1506

[Total No. of Pages : 2

[5926]-126
T.E. (Information Technology)
INTERNET OF THINGS
(2019 Pattern) (Semester - I) (314445D) (Elective - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Why 6LoWPAN plays important role in IOT. Explain in detail 6LoWPAN. **[8]**

b) What is advantages of Zigbee? Explain in detail Zigbee protocol stack. **[9]**

OR

Q2) a) Explain Piconet and Scatternet with Bluetooth. **[8]**

b) Explain data aggregation and dissemination in detail. **[9]**

Q3) a) Draw and explain interfacing of output device (Relay) using Ardiuno Uno with program. **[8]**

b) Why the python is the first choice for the Raspberry Pi language than C or C++? **[9]**

OR

Q4) a) Draw and explain interfacing of input device (LED) using Ardiuno Uno with program. **[8]**

b) What is an IOT Device? List different IOT Devices. Explain any 2 devices. **[9]**

Q5) a) Explain Data and message security and Non repudiation and availability with respect to IOT security. **[9]**

b) Explain Python Web Application Framework in detail. Explain How different amazon web services can be used for IOT? **[9]**

OR

P.T.O.

Q6) a) Explain Key elements of IOT Security in details. **[9]**

b) What is threat analysis in IOT? Explain threat analysis in detail. **[9]**

Q7) a) Explain smart city architecture with diagram also state security and privacy challenges in smart transportation in smart city. **[9]**

b) Explain in detail How IOT can be used in home automation? **[9]**

OR

Q8) a) Explain how you will design a smart water management system for agriculture using IOT. **[9]**

b) Explain in detail any two application of health monitoring using IOT. **[9]**

▽▽▽▽

Total No. of Questions : 8]

SEAT No. :

P2326

[Total No. of Pages : 2

[5870]-1144
T.E. (Information Technology)
DESIGN & ANALYSIS OF ALGORITHMS
(2019 Pattern) (Semester - I) (314445A) (Elective - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Consider 0/1 knapsack problem N = 3:W=(4,6,8) and P=(10, 12, 15).by using dynamic programming determine the optimal profit for knapsack capacity 10? **[9]**

b) Explain coin change Making problem in detail? **[9]**

OR

Q2) a) Explain how dynamic programming is used to obtain optimal solution for travelling salesperson problem. also explain why this technique is not used to solve TSP for large number of cities? **[9]**

b) What is dynamic programming? Is this the optimization technique? Give reasons what are its drawbacks? **[9]**

Q3) a) Find all possible solutions for 5 queens problem using backtracking. **[9]**

b) Current configuration is (7,5,3,l) for 8 queens problem. Find the answer tuplc using backtracking method. **[8]**

OR

Q4) a) State the principle of backtracking. Explain the constraints used in backtracking with an example. **[9]**

b) What is m colorability optimization problem. Explain with an example. **[8]**

Q5) a) Differentiate between backtracking & branch and bound. Illustrate with example of Knapsack problem. **[9]**

P.T.O.

b) Solve following Job sequencing with deadline problem using Branch and Bound. **[9]**

Job	P	d	t
1	5	1	1
2	10	3	2
3	6	2	1
4	3	1	1

OR

Q6) a) Solve the following instance of the knapsack problem by branch and bound algorithm for W=16. **[9]**

Item	Weight	Value in Rs.
1	10	100
2	7	63
3	8	56
4	4	12

b) Describe the following with respect to B & B **[9]**

- The method
- LC search
- Control abstraction for LC search
- Bounding function

Q7) a) When do you claim that algorithm is polynomial time algorithm? Explain with an example. **[9]**

b) Explain i) Complexity Classes ii) Deterministic Algorithms. **[8]**

OR

Q8) a) Explain Vertex cover problem is in detail. **[9]**

b) What is deterministic algorithm? Write any one deterministic algorithm. **[8]**

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Total No. of Questions : 4]

SEAT No. :

P8580

[Total No. of Pages : 1

Oct-22/TE/Insem-560
T.E. (Information Technology)
HUMAN COMPUTER INTERACTION
(2019 Pattern) (Semester-I) (314444)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4.***
2) ***Neat Diagram must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Assume Suitable data if necessary.***

Q1) a) List and Explain General Principles of HCl. **[5]**

b) What is HCl? Explain any two application area of HCl. **[5]**

c) Express your opinion - "A design should be User-Centric". **[5]**

OR

Q2) a) Why Study of HCl is Important? Explain in details. **[5]**

b) List and Explain different UCD principles. **[5]**

c) Explain Psychology of everyday things. **[5]**

Q3) a) "Human emotions play an important role in designing a GUI for any application" Elaborate your answer with example. **[5]**

b) What is WIMP interface? Explain how to use its elements to design user interface. **[5]**

c) List five human senses and identify those that are most important to HCl. **[5]**

OR

Q4) a) List different interaction styles. Explain command line interface with advantages and disadvantages. **[5]**

b) Explain the concept of Ergonomics with example. **[5]**

c) Differentiate between human short-term memory and long-term memory. **[5]**

Total No. of Questions : 8]

SEAT No. :

PA-1502

[Total No. of Pages : 2

[5926]-122
T.E. (E&TC)
INFORMATION TECHNOLOGY
Human Computer Interaction
(2019 Pattern) (Semester - I) (314444)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answers : Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume Suitable data if necessary.***

Q1) a) Explain Goal and task hierarchy model with example. **[8]**

b) Hierarchical task analysis (HTA) is used to describe the interactions between a user & software system. Draw & explain HTA to online Movie booking system? **[9]**

OR

Q2) a) Differentiate User Profiles with respect to Interface design with example. **[8]**

b) How does Diagrammatic dialog design notations help designers to design better interfaces. Justify your answer with an example. **[9]**

Q3) a) Explain the following golden rules with example. **[9]**

i) Strive for consistency

ii) Enable frequent users to use shortcuts

iii) Offer informative feedback

b) Explain the following with reference to interface design with example **[9]**

i) Scenarios

ii) Navigation Design

iii) Screen Design

OR

P.T.O.

Q4) a) What is Prototyping? Explain the low-fidelity and High-fidelity designs with example. **[9]**

b) Consider any online digital library, draw Model -View- Controller (MVC) framework. Mention the necessary technology solutions available for each of MVC. **[9]**

Q5) a) What are the goals of evaluation? Explain Cognitive walkthrough and heuristics evaluation technique in detail. **[8]**

b) What is Usability testing? How will you perform Usability testing on an interactive interface? **[9]**

OR

Q6) a) Explain user interface management system (UIMS) in detail along with its architecture? **[8]**

b) Explain DECIDE framework with necessary diagram and an example of the same. **[9]**

Q7) a) Explain: i) Augmented Reality ii) Virtual Reality along with real life examples of both. **[9]**

b) Discuss in the detail the Challenges faced by designer while designing interfaces for **[9]**

i) Smart homes ii) Smart devices

OR

Q8) a) Draw and explain Design thinking in detail for any suitable application. **[9]**

b) In today's world finding things on web has become very easy. Discuss how the multimodal input has enriched the experience. **[9]**

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Total No. of Questions : 4]

SEAT No. :

P8579

[Total No. of Pages : 2

Oct-22/TE/Insem-559
T.E. (IT)
MACHINE LEARNING
(2019 Pattern) (Semester - I) (314443)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates :

1) ***Answer Q.1 or Q.2, Q.3 or Q.4.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) Show how machine learning differs from traditional programming. Elaborate with suitable diagram. **[6]**

b) Explain K-fold Cross Validation technique with suitable example. **[5]**

c) What is Dataset? Differentiate between Training dataset and Testing dataset. **[4]**

OR

Q2) a) Compare Supervised, Unsupervised and Semi-supervised Learning with examples. **[6]**

b) What is the need of dimensionality reduction? Explain subset selection method. **[5]**

c) What is feature? Explain types of feature selection technique. **[4]**

Q3) a) Consider the following three-class confusion matrix. Calculate Per-Class-Precision, Per-Class-Recall, weighted average precision, weighted average recall and accuracy. **[6]**

		Predicted Values		
		A	**B**	**C**
Actual Values	**A**	45	10	05
	B	08	30	07
	C	06	04	40

P.T.O.

b) Explain One-Vs-One construction method of multiclass classifier with suitable example. **[5]**

c) Explain linear Support vector machine with suitable diagram. **[4]**

OR

Q4) a) What is multiclass classification? Explain One-Vs-Rest and One-vs-One multiclass classifier construction method with suitable example. **[6]**

b) Write a short note on : **[5]**

Various SVM kernel functions used to handle non-linear data.

c) Define the following terms : **[4]**

i) Accuracy.

ii) Precision.

iii) Recall.

iv) F1-score.

Total No. of Questions : 8]

SEAT No. :

PA-1501

[Total No. of Pages : 4

[5926]-121

T.E. (IT)

MACHINE LEARNING

(2019 Pattern) (Semester - I) (314443)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) What do you mean by coefficient of regression? Explain SSE, MSE and MAE in context of regression. **[CO2, L3]** **[5]**

b) What is multiple regression? How it is different from simple linear regression **[CO2, L1]** **[5]**

c) Consider the following data

The values of *x* and their corresponding values of *y* are shown in the table below

i) Find values of β0 and β1 w.r.t. linear regression model which best fits given data.

ii) Interpret and explain equation of regression line.

iii) Estimate the value of *y* for *x* = 90.

	x	y
1	95	85
2	85	95
3	80	70
4	70	65
5	60	70

[7]

[CO2, L3]

OR

P.T.O.

Q2) a) Explain under fit, over fit and just fit models for Regression **[CO2, L1]** **[5]**

b) Explain bias-variance dilemma **[CO2, L2]** **[5]**

c) What is univariate and multivariate regression? Explain any three measures of Evaluation of performance of regression model. **[CO2, L2]** **[7]**

Q3) a) For the given data set apply Naïve Bayes Classifier and predict the Class for weather = Sunny and car = working. **[10]**

Weather	Car	Class
Sunny	Working	Go-out
Rainy	Broken	Go-out
Sunny	Working	Go-out
Sunny	Working	Go-out
Sunny	Working	Go-out
Rainy	Broken	Stay-home
Rainy	Broken	Stay-home
Sunny	Working	Stay-home
Sunny	Broken	Stay-home
Rainy	Broken	Stay-home

[CO4, L3]

b) What is decision tree? Explain ID-3 algorithm of Decision tree in detail. **[CO4, L2]** **[8]**

OR

Q4) a) For the following data calculate weighted average entropy for all features.
Length = [3,4,5] [2+, 0–] [1+, 3–] [2+, 2–]
Gills = [Yes, No] [0+, 4–] [5+, 1–]
Beak = [Yes, No] [5+, 3–] [0 +, 2–]
Teeth = [many, few] [3+, 4–] [2+, 1–]
[CO4, L3] **[10]**

b) Define and Explain following terms **[8]**

i) Bayesian Network

ii) Advantages and disadvantages of Naïve Bayes Classifier

[CO4, L2]

Q5) a) Find all association rules using apriori algorithm in the following database in the following database with minimum support = 2 and minimum confidence = 65%. **[10]**

Transactions	Data Items
T1	Pen, Pencil, Notebook
T2	Pencil, File
T3	Pen, Pencil, Notebook, File
T4	Pen, Notebook
T5	Pencil, Scale, File
T6	Pencil, Scale
T7	Pen, Pencil, Scale

[CO5, L3]

b) What is use of K-means algorithm? Explain Centroid and medoid? Explain different types of distances measures. **[CO5, L2]** **[8]**

OR

Q6) a) Explain following Terms **[8]**

i) Rule

ii) Support

iii) Lift

iv) Confidence

[CO5, L2]

b) Apply KNN on the following data and classify the new sample (3,7) to the respective class. **[10]**

X	Y	Class
7	7	Pass
7	4	Pass
3	4	Fail
1	4	Fail
4	3	Fail
6	7	Pass
3	7	?

What will be the effect on output if k = 3 and k = 5?

[CO5, L3]

Q7) a) With the help of suitable diagram explain Biological Neuron.**[CO6, L3]** **[6]**

b) What is the use of activation function in Neural Network? Explain any two activation functions in detail **[CO6, L2]** **[6]**

c) What is deep learning? Explain different applications of deep learning. **[CO6, L1]** **[5]**

OR

Q8) a) What is perceptron? Explain multilayer perceptron in detail. **[CO6, L3]** **[6]**

b) Write a note on following activation functions. **[6]**

i) Sigmoid

ii) Tanh

iii) ReLU **[CO6, L2]**

c) What is ANN? Explain McCulloch Pitts Neuron **[CO6, L2]** **[5]**

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Total No. of Questions : 4]

SEAT No. : ____

P8578

[Total No. of Pages : 2

Oct-22 /TE/Insem-558
T.E. (Information Technology)
OPERATING SYSTEMS
(2019 Pattern) (Semester-I) (314442)

Time : 1 Hour] ***[Max. Marks : 30***

Instructions to the candidates:

1) ***Attempt Q1 or Q2, Q3 or Q4.***
2) ***Assume suitable data if necessary.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***

Q1) a) Explain the role operating system as resource manager. **[5]**

b) Give the significance of following shell commands with example: is, uniq, tail, touch grep. **[5]**

c) Describe the differences between a monolithic kernel and a microkernel. **[5]**

OR

Q2) a) What is an operating system? List and explain services provided by the operating system. **[5]**

b) Write a shell script to check if the given string is palindrome or not. **[5]**

c) Explain about the concept of virtual machines and its advantages. **[5]**

Q3) a) Consider the Set of Processes with Arrival Time, Burst Time & Priority **[8]**

Process	Arrival Time	Burst Time
P1	7	5
P2	3	4
P3	10	3
P4	0	8
P5	12	6

P.T.O.

Find Average Turnaround Time & Average Waiting Time for SJF (Preemptive)& Round Robin (Time Quantum=2) scheduling algorithms with the help of Gantt chart

b) With the help of neat, explain in detail process state transition diagram with two suspend states. **[7]**

OR

Q4) a) Discuss with the help of neat diagram different thread models. **[5]**

b) List and explain the CPU scheduling criteria. **[5]**

c) Explain with the help of neat diagram the process of context switching, also explain how program counter plays its role in context switching. **[5]**

Total No. of Questions : 8]

SEAT No. :

PA-1500

[Total No. of Pages : 3

[5926]-120

T.E. (Information Technology)
OPERATING SYSTEMS
(2019 Pattern) (Semester-I) (314442)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3. or Q.4, Q.5 or Q.6, and Q.7 or Q.8.***
2) ***Figures to the right side indicate full marks.***

Q1) a) What is semaphore and mutex? Explain with the help of pseudocode, how semaphore is used to solve producer consumer problem? **[9]**

b) What are the four necessary conditions for deadlock? How is a deadlock detected in a system with resources having single instances? Explain with an example. **[9]**

OR

Q2) a) Define mutual exclusion, race condition, semaphore. Deadlock. **[6]**

b) What is Bankers safe sequence algorithm? Apply it for finding safe sequence of execution of 5 processes in a system having Snapshot at time T0: **[12]**

	Allocation	Max	Available
	A B C	A B C	A B C
P0	0 1 0	7 5 3	3 3 2
P1	2 0 0	3 2 2	
P2	3 0 2	9 0 2	
P3	2 1 1	2 2 2	
P4	0 0 2	4 3 3	

Also determine whether following requests can be granted or not:

i) Request for process P2: - 3 0 0 and

ii) Request for process P3: - 0 0 1

P.T.O.

Q3) a) Given memory partitions of 150k, 650k, 280k, 390k and 540k (in order) how would each of the First fit, Best fir, and Worst fit algorithms place processes of 212k, 457k, 112k, 510k and 326k (in order) **[9]**

b) With the help of neat diagrams, Write a short note on Buddy system. **[8]**

OR

Q4) a) Explain Belady's anomaly with suitable example. **[6]**

b) Consider the following segment table: **[6]**

Segment	Base	Length
0	1790	350
1	2722	1050
2	520	925
3	5200	450
4	4200	655

What are the physical addresses for the following logical addresses?

i) 0,330

ii) 2,525

iii) 4,700

iv) 3,400

v) 1,1110

c) What are the distinctions among logical, relative and physical addresses? **[5]**

Q5) a) A disk drive has 200 tracks, numbered 0-199. The drive is currently serving the request at track no 53. The queue of pending requests in FIFO order is 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position what is the total distance that disk arm moves to satisfy all the pending requests for the following disk scheduling algorithms. Assume that the head is moving in the increasing order of track number for SCAN and C-LOOK. **[12]**

i) FCFS

ii) SCAN

iii) C-LOOK

iv) SSTF

b) Explain with diagrams different I/O buffering techniques. **[6]**

OR

Q6) a) List and explain different file access methods. **[9]**

b) Describe different methods of record blocking with the help of a neat diagram. **[9]**

Q7) a) What is system software? Explain any four system software in brief? **[6]**

b) Explain imperative statement, declarative statement, and assembly directive of assembly language programming? **[6]**

c) Discuss with example what is forward reference problem. **[5]**

OR

Q8) a) Explain ORIGIN, EQU and LTROG with an example. **[6]**

b) Explain the data structures required for two PASS Assembler in detail. **[6]**

c) Differentiate between literal and immediate operand. **[5]**

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Total No. of Questions : 4]

SEAT No. :

P8577

[Total No. of Pages : 2

Oct-22/TE/Insem-557
T.E. (Information Technology)
THEORY OF COMPUTATION
(2019 Pattern) (Semester - I) (314441)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates :

1) ***Answer Q.1 or Q.2, Q.3 or Q.4.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Design a DFA which accepts a binary number divisible by 4. **[5]**

b) Design a Mealy machine to increment binary number by 1. Write down transition table. **[4]**

c) Convert the following NFA with ε-moves to DFA. **[6]**

State/input	δ			
	ε	a	b	c
→ p	{q}	{p}	ϕ	ϕ
q	{r}	ϕ	{q}	ϕ
r^x	ϕ	ϕ	ϕ	{r}

OR

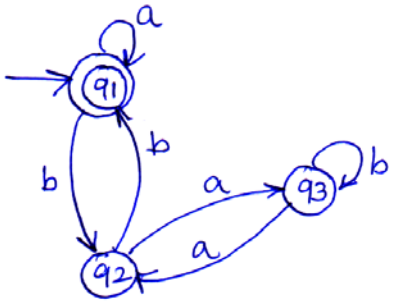
Q2) a) Define the following terms with proper examples. **[6]**

i) Alphabets

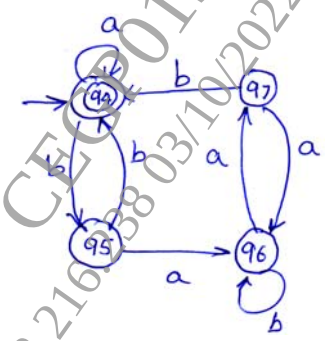
ii) String

iii) Natural language

b) Show whether the following automata m_1 & m_2 are equivalent or not. **[5]**



m_1

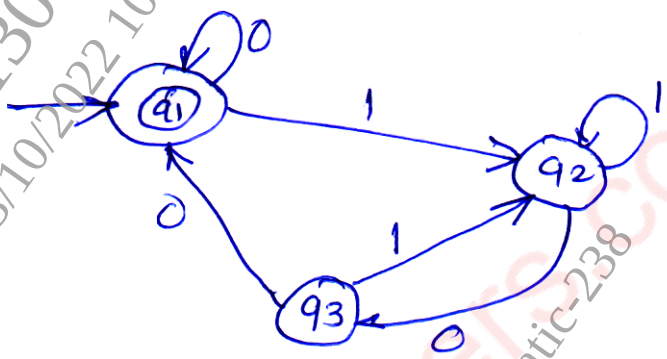


m_2

P.T.O.

c) Construct a DFA over the alphabet {a, b} for accepting the strings ending with "ab". **[4]**

Q3) a) Find the regular expression for the set of strings recognized by the given FA using Arden's theorem. **[5]**



b) Determine the regular expression over the alphabet {0, 1} for the following : **[6]**

i) All the string containing exactly two 0's

ii) All the string that do not end with 01

iii) All the string containing 1 as a third character from end.

c) Explain the following terms : **[4]**

i) Kleene closure

ii) Positive closure

OR

Q4) a) Explain any three closure properties of Regular language. **[6]**

b) What is a Regular expression? Explain in brief the applications of regular expressions. **[5]**

c) Construct a NFA for the following RE using direct method **[4]**

RE = (ab + ba)*aa

Total No. of Questions : 8]

SEAT No. :

PA-1499

[Total No. of Pages : 3

[5926]-119

T.E. (Information Technology)

THEORY OF COMPUTATION

(2019 Pattern) (Semester - I) (314441)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) What is a Regular Grammar? Explain types of regular grammar. **[5]**

b) Simplify the following CFG. **[6]**

$S \rightarrow ABA$

$A \rightarrow aA \mid \varepsilon$

$B \rightarrow bB \mid \varepsilon$

c) What is ambiguous grammar? Show that the following grammar is ambiguous and find the equivalent unambiguous grammar. **[7]**

$E \rightarrow E + E \mid E * E \mid (E) \mid I$

$I \rightarrow a \mid b$

OR

Q2) a) Write CFG for the language $L = \{a^i b^j c^k \mid i = j + k \ \& \ j, k >= 1\}$. **[6]**

b) Check whether the given language is CFL or not $L=\{a^n b^n c^n \mid n>=0\}$. **[6]**

c) Covert the following RLG to FA. **[6]**

$S \rightarrow 0A \mid 1B \mid 0 \mid 1$

$A \rightarrow 0S \mid 1B \mid 1$

$B \rightarrow 0A \mid 1S$

P.T.O.

Q3) a) Define Post machine. **[3]**

b) Design a PDA for accepting language L= { w c w^R | w ∈ (a, b)*}. **[6]**

c) Define Push down Automata. Explain different types of PDA. Explain any two applications of PDA. **[8]**

OR

Q4) a) Design a Pushdown Automata for the following language **[7]**

L = {a^n c b^n | n ≥ l}

b) Convert the grammar **[6]**

S → 0S1 | A

A → lA0 | S | ε

to PDA that accepts the same language by empty stack.

c) Compare Finite Automata and Pushdown Automata. **[4]**

Q5) a) Write a note on Universal turing Machine. **[5]**

b) Explain post correspondance problem with a suitable example. **[6]**

c) Construct a Turing machine to find 2's complement of a binary number. **[7]**

OR

Q6) a) Design a Turing Machine to increment value of binary number by one. **[8]**

b) Write short notes on **[6]**

i) Unsolvable problems

ii) Applications of Turing Machine

c) What are recursive and recursively enumerable languages? **[4]**

Q7) a) What is a Traveling Salesman Problem? Justify that it is a NP-class problem. **[8]**

b) Write short notes on **[9]**

i) A Simple Un-decidable problem

ii) Measuring Complexity

OR

Q8) a) Explain Cook's theorem in detail. **[8]**

b) Explain in detail the Node-Cover Problem. **[9]**

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