CST (7)

Reg.No.: | | | | | | | | |

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 13001

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023
Sixth Semester
Computer Science and Technology
U19CT611 – FOUNDATIONS OF DATA SCIENCE
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	How can big data analytics benefit business?	2	K2	CO1
2.	Write the significance of datafication.	2	K1	CO1
3.	In the following sample dataset, X indicates that a variable does not contain any missing values, whereas a dot (.) indicates that a variable contains missing values. Identify the best choice and write code to handle the missing values in a continuous data like height and a nominal data like Smoking.	2	K3	CO2

Missing Data Patterns

Group	AgeAtStart	Height	Weight	Diastolic	Systolic	MRW	Smoking	Cholesterol	Freq	Percent
1	X	X	X	X	X	X	X	X	5039	96.74
2	X	X	X	X	X	X	X	.	124	2.38
3	X	X	X	X	X	X	.	X	8	0.15
4	X	X	X	X	X	X	.	.	28	0.54
5	X	X	.	X	X	.	X	X	4	0.08
6	X	.	X	X	X	X	X	X	4	0.08
7	X	.	.	X	X	.	X	X	2	0.04

4.	Write R command to load data from csv and txt files.	2	K2	CO2
5.	What is skewness and kurtosis?	2	K1	CO3
6.	Calculate the Interquartile Range for the following numbers: 13,15,16,16,19,20,20,21,22,22,25,25,25.	2	K3	CO3
7.	Consider the following confusion matrix and compute accuracy and recall.	2	K3	CO4

Expected

	+ve	-ve
Predicted +ve	28	4
-ve	6	153

Q.No.	Questions	Marks	KL	CO
8.	List the metrics used to evaluate clustering models.	2	K1	CO4 CO5
9.	Realize the need for plotting the raw data.	2	K2	CO5 CO3
10.	Write R command to obtain multiple plots in one window.	2	K2	CO5 CO3

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Data Science plays a key role in Financial Industries. Financial Industries always have an issue of fraud and risk of losses. Thus, Financial Industries need to automate risk of loss analysis in order to carry out strategic decisions for the company. Also, Financial Industries uses Data Science Analytics tools in order to predict the future. It allows the companies to predict customer lifetime value and their stock market moves. Realize the stages in data science project for financial industries and identify the data security issues that needs to be addressed.	13	K4	CO1

(OR)

b)	E-Commerce Websites like Amazon, Flipkart, etc. uses data Science. Explain how data science is helpful in Ecommerce websites along with its evolution and primary roles in data science.	13	K4	CO1
12. a)	Elaborate on Data Integration and transformation techniques used in data science process.	13	K4	CO2

(OR)

b)	Discuss the data collection and data pre-processing methods used in the data science process.	13	K2	CO2

13. a) Consider the following advertisement dataset named nyt1.csv, nyt2.csv,.....nyt31.csv. The dataset represent ads shown and clicks recorded every day on the New York Times home page in May 2012. Each row represents a single user. There are five columns: age, gender (0=female, 1=male), number impressions, number clicks, and logged-in.   13   K5   CO3

Age	Gender	Impressions	Clicks	Signed_In
36	0	3	0	1
73	1	3	0	1
30	0	3	0	1
49	1	3	0	1
47	1	11	0	1
47	0	11	1	1
0	0	7	1	0
46	0	5	0	1
16	0	3	0	1

nyt.csv

Write R Command to perform the following:
1. Load the data
2. Create a new variable, age_group, that categorizes users as "<18", "18-24", "25-34", "35-44", "45-54", "55-64", and "65+".
3. For a single day:
    i. Plot the distributions of number impressions and click-through-rate (CTR=# clicks/# impressions) for these six age categories.
    ii. Define a new variable to segment or categorize users based on their click behavior.
    iii. Explore the data and make visual and quantitative comparisons across user segments/demographics (<18-year-old males versus < 18-year-old females or logged-in versus not, for example).

Create metrics/measurements/statistics that summarize the data. Examples of potential metrics include CTR, quantiles, mean, median, variance, and max, and these can be calculated across the various user segments.

(OR)

b) Explain ANOVA and various statistical distributions in R with suitable examples and code.   13   K2   CO3

14. a) Explain in detail about sampling and various evaluation measures used in a machine learning model.   13   K2   CO4

(OR)

	b)	Write in detail about Linear Regression and Logistic Regression.	13	K1	CO4
15.	a)	Explain plot() function, matrix plot and graph exporting with suitable syntax and example.	13	K1	CO3 CO5

<div align="center">(OR)</div>

	b)	Consider a life_expec.csv dataset with columns: year, race, avg_life_exp and avg_adj_death_rate.	13	K4	CO5

Year	Race	Sex	Avg_Life_Expec	Age_Adj_Death_Rate
2000	All Races	Both Sexes	6.8	869
2000	All Races	Female	79.7	731.
2000	All Races	Male	74.3	1054.

Write in detail about the graphical analysis that can be performed on the above data along with the code explanation.

<div align="center">PART – C</div>

<div align="right">(1 x 15 = 15Marks)</div>

Q.No.		Questions	Marks	KL	CO
16.	a)	Consider the following data points. P1(2,10), P2(2,5), P3(8,4), P4(5,8), P5(7,5), P6(6,4), P7(1,2), P8(4,9). Assume the initial cluster center's as P1(2,10), P4(5,8), P7(1,2). Perform clustering using K means algorithm and calculate the new cluster centers. Use Manhattan distance formula for distance calculation.	15	K5	CO5

<div align="center">(OR)</div>

	b)	Consider "Placement Season" a career guidance company is planning to create an automatic system that analyses the characteristics and behaviours of participants. After observing the past patterns of data classification, it predicts a personality type and stores its own patterns in a dataset. Illustrate and explain the steps involved in the process of knowledge discovery for the automatic analyser.	15	K4	CO1

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Question Paper Code: 13002
B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023
Sixth Semester
Computer Science and Technology
U19CT613 – CLOUD COMPUTING
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	What are the economic benefits of using a cloud based architecture?	2	K2	CO1
2.	How utility computing is related to cloud computing?	2	K1	CO1
3.	How onsite private cloud differ from out sourced private cloud and what are there inherent advantages and disadvantages.	2	K1	CO2
4.	What is the purpose of the hypervisor in a cloud-based architecture?	2	K3	CO2
5.	Discuss the following virtualization terms used in cloud computing: i. Virtual Network ii. Virtualized Networking Function (VNF)	2	K1	CO3
6.	List out the pros and cons of Hardware-assisted virtualization.	2	K1	CO3
7.	Explain the core components of Hadoop.	2	K1	CO4
8.	When to use Map Reduce with Big Data.	2	K1	CO4
9.	How to conserve energy within a Cloud environment.	2	K2	CO5
10.	What is DevOps?	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Explain the hardware architectures of parallel processing.	13	K2	CO1
	(OR)			
b)	How Distributed cloud computing works? List out some of the common properties of distributed Computing.	13	K3	CO2

12.	a)	Analyze Amazon privacy policies and design a service level agreement you would sign on if you were to process confidential data using AWS.	13	K6	CO2 CO4
		(OR)			
	b)	Compare the benefits and the potential problems due to virtualization on public, private, and hybrid clouds.	13	K4	CO3
13.	a)	Compare the three cloud computing delivery models, SaaS, PaaS, and IaaS from the point of view of the application developers and users. Discuss the security and the reliability of each one of them. Analyze the differences between PaaS and IaaS.	13	K4	CO3
		(OR)			
	b)	Do a architectural comparison between full virtualization, Para virtualization and hardware assisted virtualization. Also explain the flow of instructions execution in privileged mode.	13	K4	CO2
14.	a)	Describe the various components of Google App Engine.	13	K2	CO4
		(OR)			
	b)	Consider a document with several words (This is a cat. Cat sits on a roof) is submitted, and the Map Reduce framework is required to produce a word count list for all the available words. Give a visual explanation of how the task is processed.	13	K3	CO4
15.	a)	Elaborate on Energy efficiency in clouds.	13	K2	CO5
		(OR)			
	b)	Describe in detail about Federated cloud.	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	An organization debating whether to install a private cloud or to use a public cloud, e.g., the AWS, for its computational and storage needs, asks your advice. What information will you require to base your recommendation on, and how will you use each one of the following items:	15	K5	CO2 CO4

    i.   the description of the algorithms and the type of the applications the organization will run;
    ii.   the system software used by these applications;
    iii.   the resources needed by each application;
    iv.   the size of the user population;
    v.   the relative experience of the user population;
    vi.   the costs involved.

(OR)

| | b) | Several desirable properties of a large-scale distributed system includes transparency of access, location, concurrency, replication, failure, migration, performance, and scaling. Analyze how each one of these properties applies to AWS. | 15 | K5 | CO2 CO4 |

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Question Paper Code: 13007

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023

Sixth Semester

Computer Science and Technology

U19CT612– MACHINE LEARNING TECHNIQUES

(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	List the features of machine learning.	2	K1 K2	CO1
2.	Explain overfitting of a model? How can you avoid overfitting?	2	K1	CO1
3.	Give an advantage and a disadvantage of Bayesian regression?	2	K1	CO2
4.	Give the formulation of polynomial regression.	2	K1 K2	CO2
5.	Give some situations where you will use an SVM over a Random Forest Machine Learning algorithm and vice-versa?	2	K2 K3	CO2
6.	Explain kernel in SVM? Why do we use kernels in SVM?	2	K1 K3	CO2
7.	What is Hierarchical Clustering?	2	K1	CO3
8.	Explain DBSCAN clustering.	2	K1	CO3
9.	Explain Q-learning.	2	K1	CO5
10.	Explain value function and its formulation in reinforcement learning.	2	K1	CO5

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Explain the trade-off between bias and variance using an example.	13	K2	CO1
	(OR)			
b)	How do you handle missing data in a dataset? Explain in detail.	13	K2	CO1
12. a)	Elaborate on the three assumptions of Bayesian regression?	13	K1	CO2
	(OR)			
b)	Explain how do you make a choice in regression analysis between linear vs non-linear regression? Explain with an example.	13	K2	CO2
13. a)	Consider the following labeled data set:	13	K3 K5	CO2

S1	S2	S3	S4	CLASS
A	P	H	F	N
A	P	H	T	N
B	P	H	F	Y
C	Q	H	F	Y
C	R	L	F	Y
C	R	L	T	N
B	R	L	T	Y
A	R	L	F	Y

For the above labeled data set, using Naïve Bayes Method, what is P(Y / I) and P(N / I) for instance I=(A, P, L, T), where P stands for probability.

(OR)

b)	Explain how it is possible to get feature importance in Random Forest using Out of Bag Error.	13	K3	CO2
14. a)	List and explain the Input parameters given to the DBSCAN Algorithm.	13	K1 K3	CO3
	(OR)			
b)	Explain the Stopping Criteria for k-Means Clustering.	13	K1 K3	CO3
15. a)	What do you understand about Bellman equations in the context of reinforcement learning? Describe in detail.	13	K1	CO5
	(OR)			
b)	What are the advantages of using Monte Carlo Policy Gradient methods? Explain with an example.	13	K1	CO5

(1 x 15 = 15 Marks)

Q.No.	Questions	Marks	KL	CO

16. a) Let the points in the figure below be non-linearly separable data. Blue dot points are (-2,2), (-2,-2), (2,2) and (2,-2) belonging to +1 class. Red square points are (-1,1), (-1,-1), (1,1) and (1,-1) belonging to -1 class.   15   K5   CO2
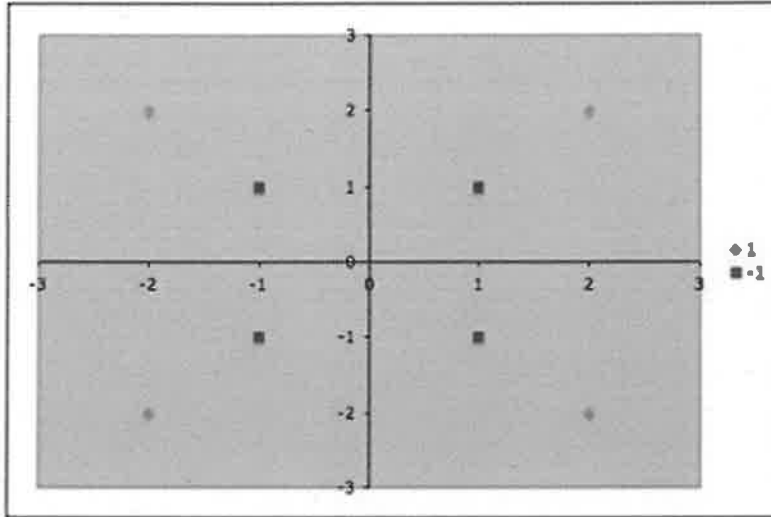
Mapping function is given as:

$$\Phi_1\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{cases} \begin{pmatrix} 4 - x_2 + |x_1 - x_2| \\ 4 - x_1 + |x_1 - x_2| \end{pmatrix} & \text{if } \sqrt{x_1^2 + x_2^2} > 2 \\ \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} & \text{otherwise} \end{cases}$$

Using SVM formulation,
   i.   Find the transformation of blue dot points belonging to +1 class and find the support vectors.
   ii. Write the generating function as y = wx+b and find the weights w and b.

(OR)

b) From the given data, calculate the regression equation taking   15   K5   CO2
deviation of item from the mean of the x and y series.

x	1	3	5	7	9	4	6
y	2	4	3	7	5	6	2

3

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Question Paper Code: 13003
B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023
Fourth Semester
Computer Science and Technology
U19CT405 – COMPUTER NETWORKS
(Regulation 2019)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Differentiate between LAN, MAN and WAN.	2	K4	CO1
2.	Explain circuit switching and packet switching.	2	K4	CO1
3.	What is a subnet mask? Give example.	2	K3	CO2
4.	Differentiate between private IP address and Public IP address.	2	K3	CO2
5.	What is the challenge in Distance Vector Routing?	2	K3	CO5
6.	Define Static Routing. Give an example.	2	K3	CO5
7.	What is the significance of flow control?	2	K4	CO4
8.	What is hamming distance in error detection?	2	K4	CO4
9.	Define Network Latency for a network.	2	K4	CO1
10.	What is the Bandwidth of a network?	2	K4	CO1

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Discuss different types of Network Topology and compare them.	13	K3	CO1
		(OR)			
	b)	Compare between OSI and TCP/IP Protocol suite.	13	K4	CO1
12.	a)	Explain classful addressing with appropriate example.	13	K3	CO2
		(OR)			
	b)	Explain and differentiate between subnetting and supernetting with appropriate examples.	13	K3	CO2
13.	a)	Compare and explain static routing and dynamic routing.	13	K3	CO5
		(OR)			
	b)	Explain the working of RIP.	13	K3	CO5
14.	a)	Explain different flow control mechanisms in detail.	13	K4	CO4
		(OR)			
	b)	Discuss error detection and correction mechanisms used in computer networks.	13	K4	CO4
15.	a)	Discuss any three types of transmission media in detail.	13	K3	CO3
		(OR)			
	b)	Discuss the physical layer characteristics of 802.11, 802.15.4 and 802.16.	13	K3	CO3

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Discuss the working of Border Gateway Protocol and its configuration in detail.	15	K3	CO5
		(OR)			
	b)	Discuss the intermediate devices used in Computer Networks.	15	K3	CO2

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	How to define Artificial Intelligence? What are the scopes and objectives of AI?	2	K1	CO1
2.	How the concept of Cybernetics evolved as building block of AI.	2	K2	CO1
3.	What is state space representation of the game tic-tac-toe?	2	K1	CO2
4.	What is Alpha - Beta processing?	2	K4	CO2
5.	Give an outline concept of LISP and PROLOG.	2	K1	CO3
6.	Discuss in brief how logic can help AI in complex domain.	2	K3	CO3
7.	What do you mean by Knowledge Based Decision making in AI?	2	K2	CO4
8.	How to define *Approximate Reasoning* connected to Knowledge Management in AI?	2	K2	CO4
9.	What are the basic components to design Vision Based Expert System in AI?	2	K3	CO5
10.	Give a brief outline of using AI in Natural Language Processing.	2	K6	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	What is the role of Artificial Intelligence in decision making? What are the different interpretations made by researchers for defining the scope and view of Artificial Intelligence? Also discuss the limitations of AI systems.	13	K1	CO1

(OR)

b)	Define agents with examples in AI? Describe salient features of an agent. Discuss about agent environment and its characteristics. What is a rational agent and an autonomous agent?		13	K2	CO1

12. a) What is Heuristic Search in AI? Explain DFS (Depth First Search) algorithm. Compare the performance of A* and IDFA* (Iterative Deepening A*) in terms of *Space* and *Time complexity.*   13   K2 K4   CO2

(OR)

b) Discuss how *Hill - Climbing algorithm solves* the problems to maximize or minimize a given real function by selecting values from the given inputs. Also describe *Steepest-Ascent Hill Climbing* and Random *Restart Hill Climbing.*   13   K1 K2   CO2

13. a)   i.   Define Predicate Calculus as representation language of Artificial Intelligence. Discuss about the *symbols* and connectives of propositional calculus.   6   K2   CO3

        ii.   Define *sentences* and semantics of propositional calculus. Introduce the concept of truth *tables for logical expression* using *inference.*   7   K4   CO3

(OR)

b) Explain Semantic Tableau system in propositional logic.   13   K2   CO2

14. a)   i.   What is the need of combining different reasoning models as Hybrid Model in Artificial Intelligence? Demonstrate with some real life problems the efficacy of Hybrid Model for knowledge based reasoning.   7   K2   CO4

        ii.   What is the task of a planner to organize procedure for a potential solution? Explain traditional robot plan composed for robot's atomic actions.   6   K6   CO4

(OR)

b) How Machine Learning can facilitate the development of computer programs for learned knowledge representation? Describe the process of learning. How to differentiate the machine learning from traditional programming? Explain Supervised, Unsupervised and Reinforcement learning approaches with illustrations.   13   K2   CO4

15. a)   i.   What is Bayes' Theorem for prediction of occurrence of events or classification of pattern in a probable class /classes? Explain in details the design of expert system.   7   K1   CO5

        ii.   How Bayesian Belief Model modifies the conventional Stochastic Bayesian approach in decision making. Discuss with graphical model.   6   K2   CO5

(OR)

b)   i.   What are the scopes of *Uncertainty* in Artificial Intelligence? Explore the concept of Fuzzy Set approach which proposes possibility theory as a measure of vagueness and imprecision by introducing membership function.   7   K2   CO5

   ii.   How the Dempster Shafer theory of Evidence assigns the sets of propositions in the interval of *belief* and *plausibility* in uncertain situation?   6   K4   CO5

PART – C

(1 x 15 = 15Marks)

Q.No.	Questions	Marks	KL	CO
16. a) i.	Elaborate the concept of "Expert System Design" in Artificial Intelligence. Explain all basic features and characteristics of Expert System. Demonstrate the basic architecture of a typical Expert System for a particular problem domain.	9	K2	CO5
ii.	Discuss the "MYCIN" Expert System for decision making in Healthcare.	6	K3	CO5

(OR)

b)	Explain the extended Semantic networks for knowledge representation.	15	K2	CO3

3

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Question Paper Code: 6011

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – May 2023
Fourth Semester
Computer Science and Technology
U19IT408 – OPERATING SYSTEMS
(Regulation 2019)
(Common to Information Technology)

Time: Three Hours   Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels	K1 – Remembering	K3 – Applying	K5 - Evaluating
(KL)	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Mention the significance of multiprogramming? Give an example of a multi-programmed OS.	2	K2	CO1
2.	What is context switch? Write two features of a real time operating system.	2	K1	CO1
3.	Differentiate between a non-preemptive and a preemptive CPU scheduling with example.	2	K2	CO2
4.	Three processes with P1, P2 and P3 arrives at the same time with burst time respectively 2, 4, 2 msec. If you use RR scheduling with quantum size 2. Calculate the average waiting time for P2.	2	K3	CO2
5.	What are the basic requirements for solving a critical section problem?	2	K2	CO3
6.	There are three processes that requires 2 instances of a single-type resource together for execution. Identify the minimum number resource instances such that all three processes execute without deadlock?	2	K3	CO3
7.	Average access time for main memory is 50 milliseconds and access time for cache memory is 5 microsecond. If the cache hit ratio is 50%, determine the average access time to access a memory location?	2	K3	CO4
8.	Comment on the statement given. "using best fit allocation algorithm over first fit".	2	K2	CO4

9.	A disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests in FIFO order is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. If SCAN scheduling is used, estimate the total distance that disk arm will move to satisfy all pending requests?	2	K3	CO5
10.	Compare the fairness of FCFS and SSTF disk scheduling algorithms.	2	K2 K3	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Identify and write the advantage of microkernel approach to system design? State the differences between distributed and parallel systems with diagrams.	6	K1	
						CO1
		ii.	Using system calls, describe the process of reading data from one file and copies it to another file.	7	K2	
			(OR)			
	b)	i.	Under what circumstances system calls are to be generated? Differentiate between a trap and an interrupt. Provide an example of a privileged instruction.	7	K1	
						CO1
		ii.	Describe use of dual-mode operation, memory protection and timer for protecting operating systems.	6	K2	
12.	a)	i.	Illustrate the process state transition diagram and explain with examples when each transition occurs.	5	K1	
						CO2
		ii.	Depict the producer-consumer scenario using flow diagrams, provide a solution to the identified problem using semaphores and mention what kind of problems can happen?	8	K2	
			(OR)			
	b)	i.	A traditional UNIX scheduler enforces an inverse relationship between priority numbers and priorities: The higher the number, the lower the priority. The scheduler recalculates process priorities once per second using the following function: Priority = (recent CPU usage / 2) + K, where K = 60 and recent CPU usage refers to a value indicating how often a process has used the CPU since priorities were last recalculated. Assume that recent CPU usage for process P1 is 40, process P2 is 18, and process P3 is 10. What will be the new priorities for these three processes when priorities are recalculated?	6	K1	CO2
		ii.	Provide a software solution for the mutual exclusion that satisfies all basic requirements. Define a semaphore.	7	K2	

13.	a)	i.	A computer system has 9 printers with N processes competing for them. Each process needs 3 printers together to finish the task. What is the maximum possible value of N for the system to be deadlock free?	5	K2 K3	CO3
		ii.	A 32-bit system has a 4-way set cache of size 32KB. Each block in the cache is of size 64B. Calculate the total size of the tag array. Assume that the system has no virtual memory and is byte addressable.	8	K4	CO3

(OR)

	b)	i.	What are the reasons for the occurrence of deadlock in computing systems? How to avoid that?	3	K2	CO3
		ii.	What are the four sufficient and necessary conditions for deadlock to occur in a system? Explain with an example. Describe Deadlock Detection Algorithm with an example.	10	K3	CO3
14.	a)	i.	A system uses 64 bit virtual address of 32KB page size. A page table entry is 10Byte including the valid bit for the entry. Find the size of the physical address space that can be used in the system.	7	K4	CO4
		ii.	A system using virtual addressing mechanism, consists of L1 cache of size 64 KB with access time of 5 cycles and TLB of 64 entry size with access time 1 cycle. Application has 99% and 90% TLB and cache hit rates, respectively. If the system, without cache or TLB, takes 200 cycles, find the average memory access time of the system.	6	K5	CO4

(OR)

	b)	i.	Consider a cache which has a capacity of 4 blocks. Explain how LRU (Least recently used) replacement policy can be established. The block addresses given are follows: 5 7 2 5 6 2 7 9 0 6. Illustrate the block status and indicate which blocks are hit / miss.	7	K4	CO4
		ii.	A system using virtual addressing mechanism, consists of L1 cache of size 32 KB with access time of 4 cycles and TLB of 32 entry size with access time 1 cycle. Application has 97% and 90% TLB and cache hit rates, respectively. If the system, without cache or TLB, takes 250 cycles, find the average memory access time of the system.	6	K5	CO4
15.	a)		A real-time processor requires reading a block of data from an input device. Clearly show the steps of interactions between CPU, Memory Controller, I/O controller, and DMA controller for performing the read operation using the following techniques: Programmed I/O, Interrupt driven I/O, DMA based I/O	13	K2 K3	CO5

(OR)

			Marks	KL	CO
b)	i.	What are all the parameters to be considered in deciding the allocation strategy (contiguous, linked and indexed) is best utilized for a particular file?	6	K2	CO5
	ii.	UNIX File systems find data block via indirection table called inodes. How it can be used for improving disk performance? Describe UNIX Inode structure.	7	K3	

PART – C

(1 x 15 = 15Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Consider the following snapshot of a system:	10	K4	CO3
	i.	Illustrate the resource allocation graph for the given system. Do you think the given system is in deadlock? If so, explain the condition of deadlock in the system and propose a method to resolve the deadlock. Propose a total quantity matrix that will guarantee that there will be no deadlock in the following system.			

Process	Resource	Total Quantity	Presently Hold	Presently Requested
P1	R1	2	1	0
P1	R2	1	0	1
P1	R3	2	0	0
P2	R1	2	1	1
P2	R2	1	1	0
P2	R3	2	1	0
P3	R1	2	0	0
P3	R2	1	1	0
P3	R3	2	1	0

			Marks	KL	CO
	ii.	Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6 Determine the number of page faults considering 4 frames.	5	K5	CO4

(OR)

			Marks	KL	CO
b)	i.	A system using virtual addressing mechanism, consists of L1 cache of size 64 KB with access time of 5 cycles and TLB of 64 entry size with access time 1 cycle. Application has 99% and 90% TLB and cache hit rates, respectively. If the system, without cache or TLB, takes 200 cycles, find the average memory access time of the system.	8	K4	CO3
	ii.	Consider a system consisting of m resources of the same type, being shared by n processes. Resources can be requested and released by only one at a time. Derive a condition on maximum need of each process and sum of all maximum need to guarantee the system is deadlock-free.	7	K5	CO4

4