

Total No. of Questions : 5]

SEAT No. :

P2824

[Total No. of Pages : 4

[4837] - 104

**M.Sc. (Semester - I)**

**COMPUTER SCIENCE**

**CS - 104 : Design and Analysis of Algorithms**

**(2008 & 2011 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates :*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*

**Q1)** Attempt any Eight from the following :

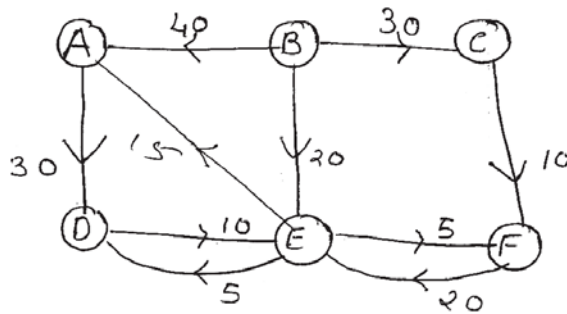
**[8 × 2 = 16]**

- a) What is the  $\theta$  notation?
- b) What operations does heap data structure support and what is the growth rate of these operations?
- c) Why quick sort is called partition & exchange sort?
- d) Greedy strategy may not always yields optimal solution Justify.
- e) What is principle of optimality?
- f) What is the difference between tree edge and forward edge in DFS spanning tree?
- g) Define Brute force approach.
- h) Why bounding functions are useful in context of branch and bound strategy?
- i) Define interpolation problem.
- j) State cooks theorem.

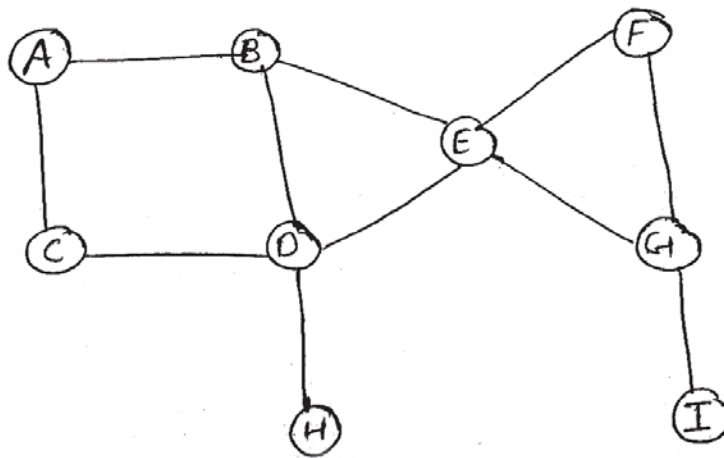
**P.T.O.**

**Q2)** Answer any four from the following : **[4 × 4 = 16]**

- a) Let  $A[1 \dots n]$  be sorted array of distinct Integers some of which may be negative. Give an algorithm based on divide and conquer strategy that can find an index  $i$  such that  $1 \leq i \leq n$  &  $A[i] = i$  provided such an index exists. What is its time complexity.
- b) Order the following function in ascending order of the growth rate.  
 $n^2 \log n$ ,  $30n^2$ ,  $n \log n$ ,  $\log n$ ,  $2^n$ .
- c) Find an Optimal solution to the knapsack problem instance  $n = 7$ ,  $m = 15$ ,  $p = (12, 6, 15, 7, 6, 20, 3)$ . and  $w = \{2, 3, 5, 7, 2, 5, 1\}$  using greedy strategy.
- d) Apply dijkstra's algorithm on following graph [start vertex B]

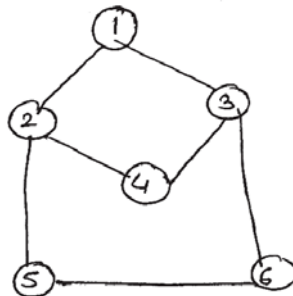


- e) Find the DFS spanning tree for the following diagram. Show all steps. [start Vertex A].

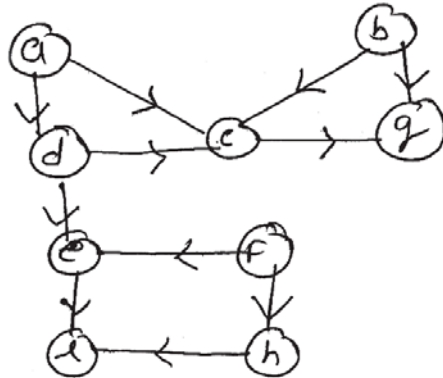


**Q3)** Answer any four from the following : **[4 × 4 = 16]**

- a) What is Hamiltonian cycle. Find all the Hamiltonian cycle for the following graph.



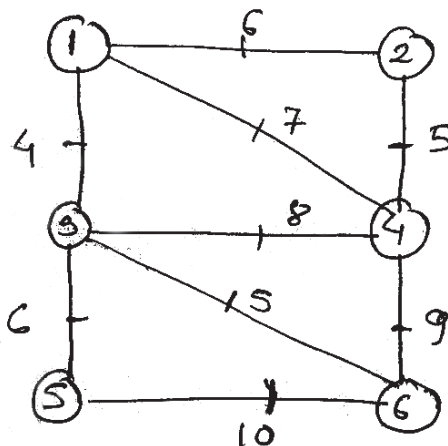
- b) Draw the portion of the state space tree generated by ZCBB for 0/1 knapsack problem instance given by  $n = 3$ ,  $p = (8, 5, 5)$ ,  $w = (6, 5, 5)$   $m = 10$ .
- c) Find the topological sort of the following graph.



- d) Write non deterministic algorithm to sort set of  $n$  positive integers.
- e) Discuss different asymptotic notations in analysis of algorithm and what properties are satisfied by these notations.

**Q4) Answer any Two from the following : [2 × 8 = 16]**

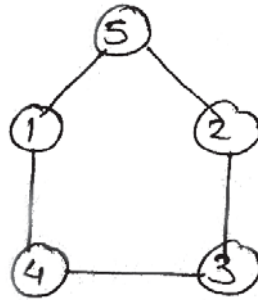
- a) A string  $X$  can be transformed into a string  $Y$  by applying sequence of edit operation such as insert, delete, change with cost 1, 1, and 2 respectively. Give recurrence relation for value of optimal solution where problem is solved using dynamic programming for  $X = b, b, a, b, a$  and  $Y = a, b, a, a$ , Give the matrix of values in bottom up manner.
- b) Find the minimum spanning tree for the following graph using Kruskal's and Prim's algorithm.



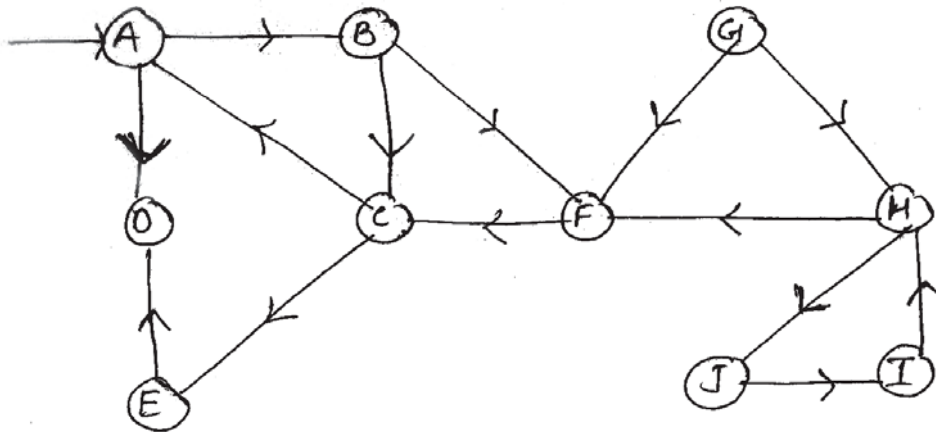
- c) Write an algorithm to sort ' $n$ ' elements using quick sort algorithm in ascending order. Discuss the best case and worst case time complexity of it.

Q5) Answer any Two from the following : [2 × 8 = 16]

- a) What is m - colorability graph problem? Give explicit and implicit constraints for m - colorability problem with 'n' nodes. For the following graph find out all possible solution with m = 3.



- b) What is strongly connected components of a directed graph? Write algorithm for finding strongly connected graph. Find strongly connected components of the following graph G using the algorithm. [start vertex A].



- c) Explain branch and bound method in brief. Consider the travelling salesman instance defined by the following cost matrix.

$$\begin{bmatrix} \infty & 11 & 10 & 9 & 6 \\ 8 & \infty & 7 & 3 & 4 \\ 8 & 4 & \infty & 4 & 8 \\ 11 & 10 & 5 & \infty & 5 \\ 6 & 9 & 5 & 5 & \infty \end{bmatrix}$$

Obtain the reduce cost matrix which node will be selected next ZCBB formulation of problem.



Total No. of Questions : 8]

SEAT No. :

P2825

[Total No. of Pages : 3

[4837] - 201

M.Sc. (Semester - II)

COMPUTER SCIENCE

CS - 201 : Digital Image Processing  
(2011 Pattern)

Time : 3 Hours]

[Max. Marks : 80

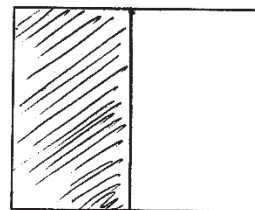
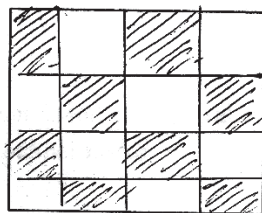
Instructions to the candidates :

- 1) Question 1 is compulsory.
- 2) Attempt any four from the remaining.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.

Q1) Attempt all :

[8 × 2 = 16]

- a) List any four energy sources for getting image.
- b) Calculate the memory required to store a gray image that has a resolution of  $1024 \times 1024$  and has 256 different levels of intensity.
- c) Define m-adjacency for two pixels 'p' and 'q' of an image.
- d) Which of the following will require higher sampling rate?



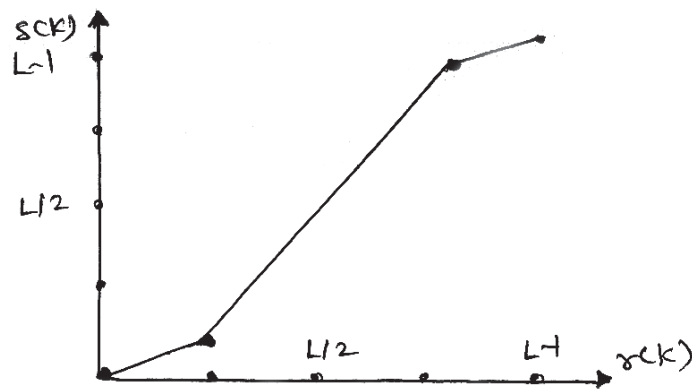
- e) Write correct equations for forward DFT.
- f) The equation for Gaussian low pass filter is given below. Write the equation for corresponding Gaussian high pass filter.  
$$H(u, v) = e^{-D^2(u, v)/2D_0^2}$$
- g) Write the expression used for boundary extraction.
- h) Which image feature will be detected if following mask is used?

0	1	1
-1	0	1
-1	-1	0

P.T.O.

- Q2)** a) Describe the functions of different components of an image processing system with the help of a block diagram. [8]
- b) Write any four noise probability density functions, draw their shapes and also mention one source of each. [4]
- c) What are the desired characteristics of different ways to represent a segmented data? Write a short note on chain codes. [4]

- Q3)** a) Give three different ways of acquiring image and explain any one in details. Mention one application of each method. [8]
- b) What is the effect of applying following transformation on an image? Justify your answer. [4]



- c) Write the expression for contraharmonic mean filter and mention how to use it for reducing salt noise and pepper noise. [4]

- Q4)** a) A 3-bit image of size  $64 \times 64$  has the intensity distribution as given in following table. Calculate and plot the transformation function using histogram equalization technique. [8]

$r_k$	$n_k$
0	987
1	867
2	745
3	564
4	329
5	259
6	245
7	100

- b) Calculate 'city-block' and 'chess-board' distances between two pixels  $p(40, 50)$  and  $q(44, 54)$  of an image. [4]
- c) Explain power-law transformations and their application using appropriate diagrams. [4]
- Q5)** a) What is the use of 'Hit-or-Miss' transformation? Explain the morphological operations involved in this transformation using suitable diagrams. [8]
- b) What is spatial resolution and intensity resolution? Explain their significance. [4]
- c) Explain the concept of bit-plane-slicing and mention its application. [4]
- Q6)** a) Following is a 1-D intensity profile of an image. Calculate and plot first and second order derivatives of it. Explain the nature and use of each derivative. [8]
- |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 8 | 8 | 8 | 7 | 6 | 5 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
- b) Mention any two arithmetic operations used in image processing and explain the application of each operation in brief. [4]
- c) Explain the process of homomorphic filtering. Mention its application. [4]
- Q7)** a) What are the steps of filtering in frequency domain? Write convolution theorem and explain significance of each step in frequency domain filtering. [8]
- b) Explain what is meant by unsharp masking and highboost filtering. [4]
- c) Draw the model of image degradation/restoration and explain the process. [4]
- Q8)** a) Define morphological operations of 'Dilation' and 'Erosion'. Draw appropriate diagrams to illustrate their effects on an image. [8]
- b) Write the adaptive median filtering algorithm along with the notations used. [4]
- c) Define 1-D convolution and find out the convolution of following 1-D sequences. [4]
- {1, 2, 5, 4} and {-3, 5, 1, 7}



Total No. of Questions : 5]

SEAT No. :

P2826

[Total No. of Pages : 7

[4837] - 202

**M.Sc. (Semester - II)**

**COMPUTER SCIENCE**

**CS - 202 : Advanced Operating Systems**

**(2011 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates :*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *All questions carry equal marks.*
- 4) *Figures to the right indicate full marks.*

**Q1)** Attempt all of the following :

**[8 × 2 = 16]**

- a) What is the difference between a process executing in user mode and a process executing in kernel mode?
- b) Explain the syntax of open function to create and open the file.
- c) State the different ways to carry out abnormal termination of process.
- d) Give any two advantages of opportunistic Allocation?
- e) What do you mean by pending signal? Which function is used to retrieve pending signals?
- f) Give the division of windows priority levels with suitable diagram.
- g) State and explain any two memory allocation functions specified by ISO C.
- h) Explain the system calls used to create hard links and soft links.

***P.T.O.***



**Q2) Justify the following (any Eight) :** **[8 × 2 = 16]**

- a) Although the system executes in one of two modes, the kernel runs on behalf of a user process.
- b) Every process has one parent process but a process can have many child process.
- c) Process never uses byte offset to access the data in file.
- d) Returning an integer value from the main function is equivalent to calling exit with the same value.
- e) Preventing errors generated by strcmp ( ) and strcpy ( ) is upto the programmer.
- f) The sigqueue ( ) function working is not similar to kill ( ).
- g) Windows is a portable operating system.
- h) Using job control from a shell, we can start a job in either the foreground or background.
- i) The working of chmod ( ) and fchmod ( ) is identical.
- j) Quantum values can vary from system to system and process to process.

**Q3) Attempt any four of the following :** **[4 × 4 = 16]**

- a) Explain any four services provided by the kernel of UNIX operating system.
- b) Discuss the upside and downside of buddy memory allocation scheme.
- c) Explain the following signal set operations :
  - i) sigempty set ( )
  - ii) sigfillset
  - iii) sigaddset ( )
  - iv) sigdelset
- d) Explain any four kernel - mode components of windows.
- e) Discuss the various events of thread dispatching.

**Q4)** Explain the behavior of following “C” programs (any four) : [4 × 4 = 16]

```
a) # include <stdlib. h>

# include <stdio. h>

# include <unistd. h>

# include <signal. h>

Static void sigint_handler (int signo)

{

    Printf (“Caught SIGINT”);

    exit (EXIT_SUCCESS);

}

int main (void)

{

    if (signal (SIGINT, sigint_handler) ==SIG_ERR)

    {

        fprintf (stderr, “cannot handle SIGINT”);

        exit (EXIT_FAILURE);

    }

    for (; ;)

        pause ( );

    return 0;

}
```

```

b) # include <unistd. h>
    int main (void)
    {
        char *cwd;
        cwd = get cwd (NULL, 0);
        if (! cwd)
        {
            perror (“getcwd”);
            exit (EXIT_FAILURE);
        }
        printf(“cwd =%s \n”, cwd);
        free (cwd);
    }

c) # include <fcntl. h>
    main ( int argc, char *argv[ ])
    {
        int fd, skval;
        char c;
        if (argc! = 2)
            exit ( );
        fd = open (argv[1], O_RDONLY);
        if (fd == -1)
            exit ( );
        while (skval ==read (fd, &C, 1)==1)
        {
            printf(“char% c\n”, c);
            skval = lseek (fd, 1023L, 1);
            printf(“new lseek val%d\n”, skval);
        }
    }

```

```

d) # include <fcntl.h>

int main (void)
{
    int fd;

    char lilbuf[20], bigbuf [1024];

    fd = open ("/etc/passwd", O_RDONLY);
    read (fd, lilbuf, 20);
    read ( fd, bigbuf, 1024);
    read (fd, lilbuf, 20);

}

e) # include <unistd.h>

# include <stdio.h>
# include <sys/types.h>
# include <sys/ wait.h>
int main (void)
{
    int status;

    pid_t pid;

    pid = waitpid (1742, & status, WNOHANG);
    if(pid == -1)
        perror("wait Pid");
    else
        {
            printf("pid = %d\n", pid);
            if (WIFEXITED(status))
                printf("Normal Termination");
        }
}

```

```

f) # include <signal .h>

int main (int argc, char *argv [ ])
{
    char buf [256];

    if (argc! = 1)

        signal (SIGCLD, SIG_IGN);

    while (read (0, buf, 256))
    {
        if ( fork( ) == 0)
        {
            exit(0);
        }
    }
}

```

**Q5)** Write a “C” program for the following (Any Four) : **[4 × 4 = 16]**

- a) Write a program showing the use of atexit( ) function.
- b) Write a program that prints the size and inode number of a given file.
- c) Write a program to print the names of the signal in the signal mask of the calling process.

- d) Write a program which opens a file and goes to sleep for 10 seconds before terminate.
- e) Write a program to implement your own Sigzstr function.
- f) Write a C program that calls sleep(20) in an infinite loop. Every five times through the loop (every 5 minutes), fetch the current time of a day and print the tm\_sec field.



Total No. of Questions : 5]

SEAT No. :

P2827

[Total No. of Pages : 4

[4837] - 203

**M.Sc. (Semester - II)**

**COMPUTER SCIENCE**

**CS - 203 : Data Mining and Data Warehousing**

**(2011 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates :*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Answer **any eight** of the following :

**[8 × 2 = 16]**

- a) Define: data characterization in data mining.
- b) Give any 2 differences between database systems and data warehouses.
- c) Define Support and Confidence in data mining.
- d) Define: outlier analysis.
- e) Data mining is applicable for any kind of information repository. Justify.
- f) How does data cube support multi- dimensional data model?
- g) Define frequent itemset.
- h) What do you understand by datamining metrics?
- i) Define : confusion matrix.
- j) List any 2 major strengths of decision tree method.

***P.T.O.***

**Q2)** Answer **any 4** of the following :

**[4 × 4 = 16]**

- a) State and explain in brief the major issues in datamining.
- b) Explain data cleaning as a process. What are the steps involved?
- c) Explain the different OLAP operations in data warehouse architecture.
- d) Explain the steps in knowledge discovery in databases.
- e) Why is naive bayesian classification called 'naïve'? Briefly outline the major ideas of naïve bayesian classification.

**Q3)** Answer **any 2** of the following :

**[2 × 8 = 16]**

- a) The following table contains the transactions along with the itemsets. Construct a Frequent pattern tree for the same.

TID	Items
1	A,B,E
2	B,C,D
3	C,E
4	A,C,D
5	A,B,C,D
6	A,E
7	A,B
8	A,B,C
9	A,C,D
10	B



- b) A large supermarket tracks the sales data by stock-keeping unit for each item. Apply Apriori algorithm for the following table with the Min\_sup count as 4 to identify the items that are purchased together.

(Tran. id)	Itemset
1	{1,2,3,4}
2	{1,2,3,4,5}
3	{2,3,4}
4	{2,3,5}
5	{1,2,4}
6	{1,3,4}
7	{2,3,4,5}
8	{1,3,4,5}
9	{3,4,5}
10	{1,2,3,5}

- c) Draw a decision tree for the given table.

Num	Size	Colour	Shape	Satisfied
1	Med	Blue	Brick	Yes
2	Small	Red	Wedge	No
3	Small	Red	Sphere	Yes
4	Large	Red	Wedge	No
5	Large	Green	Pillar	Yes
6	Large	Red	Pillar	No
7	Large	Green	Sphere	Yes

**Q4)** Answer **any four** of the following : **[4 × 4 = 16]**

- a) Summarize the role of data mining in web mining.
- b) Discuss the social impact of datamining.
- c) Explain Sampling algorithm with an example.
- d) Discuss data integration and data transformation in detail.
- e) What are the ways by which text are retrieved in text mining.

**Q5)** Answer **any four** of the following : **[4 × 4 = 16]**

- a) Write a note on web taxonomy.
- b) Discuss the architecture of data warehouse.
- c) Explain Bootstrap.
- d) Explain Data Mart in DataWarehousing.
- e) Suppose that a data ware house for Big University consists of the following four dimensions: student, course, semester, and instructor, and two measures count and avg\_grade. When at the lower conceptual level (e.g., for a given student, course, semester, and instructor combination), the avg\_grade measure stores the actual course grade of the student. At higher conceptual levels, avg\_grade stores the average grade for the given combination.

Draw a snowflake schema diagram for the data warehouse.



Total No. of Questions : 5]

SEAT No. :

P2828

[Total No. of Pages : 3

[4837] - 301

**M.Sc. (Semester - III)**

**COMPUTER SCIENCE**

**CS - 301 : Software Metrics and Project Management  
(2011 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates :*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Figures to the right indicate full marks.*

*Q1)* Attempt the following :

**[8 × 2 = 16]**

- a) What are the attributes types of project?
- b) What are the different types of dependencies between activities or task?
- c) Define :
  - i) Schedule variance
  - ii) Cost performance Index
- d) Give any 4 aspects of information technology project that affects quality.
- e) Give the different quality models used in software metrics.
- f) Differentiate any 4 points between software reliability and hardware reliability.
- g) Give any 4 methods of selection of project.
- h) What are the different types of power the project manager has?

***P.T.O.***

**Q2)** Attempt any 4 of the following : **[4 × 4 = 16]**

- a) Explain any 4 tools and techniques used for risk quantification.
- b) What are the various methods of improving project communication management? Explain any 2 in detail.
- c) Write a short note on Earned value Analysis.
- d) Explain the planning process in Quality project management.
- e) State the important processes involved in Human resource management.

**Q3)** Attempt any 4 of the following : **[4 × 4 = 16]**

- a) Explain the organizational structure used in software project management?
- b) Explain the tools and techniques used in schedule development process.
- c) Explain change control process in project integration management.
- d) Explain the internal attribute structure of software metrics.
- e) What is CMM and explain the phases in CMM model.

**Q4)** Attempt any 4 of the following : **[4 × 4 = 16]**

- a) What are the tools and techniques used for developing WBS?
- b) Write a note on solicitation planning.
- c) Explain in brief reliability growth problem.
- d) Explain the 'why and what' of metrics plan.
- e) How software metrics can help software developers project managers and customers?

**Q5)** Attempt any 4 of the following :

**[4 × 4 = 16]**

- a) Explain in detail project plan development process.
- b) How do we measure productivity? How does team structure affects productivity?
- c) Explain any four activities involved in software measurement.
- d) Construct the project charter for the Air craft system.
- e) Explain the roles and responsibilities of measurement team.



Total No. of Questions: 5]

SEAT No. :

P2829

[Total No. of Pages : 2

**[4837] - 302**  
**M.Sc. (Computer Science)**  
**CS - 302 : Mobile Computing**  
**(Semester-III) (2011 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Neat diagram must be drawn whenever necessary.*

**Q1)** Attempt all of the following.

**[16]**

- a) Define user mobility & device portability.
- b) What are the main benefits of spread spectrum system?
- c) Discuss near & far terminals.
- d) Give any two requirements of mobile IP.
- e) Write any two advantages of I-TCP.
- f) Explain the use of broadcast control channel.
- g) Define the functionality of node B used in UTRA.
- h) List four J2ME profile.

**Q2)** Attempt any Four of the following.

**[16]**

- a) How wireless transport layer establishes a secure session?
- b) What is the reaction of standard TCP incase of packet loss? Why it is quite often problematic in the case of wireless network & mobility?
- c) Explain J2ME architecture.
- d) Discuss the features of Android.
- e) Explain different types of handover used in UMTS.

**P.T.O.**

**Q3)** Attempt any Four of the following. **[16]**

- a) Explain the UTRAN architecture.
- b) Discuss LCS logical reference model.
- c) Which are the components of GPRS? What is their purpose?
- d) What are the advantages & disadvantages of mobile TCP?
- e) How does destination sequence distance vector routing handle routing?

**Q4)** Attempt any Four of the following. **[16]**

- a) What is reverse tunneling? Why it is needed in mobile IP?
- b) Compare between FDMA & TDMA
- c) Explain cellular IP with its advantages & disadvantages.
- d) Discuss various applications of mobile communication.
- e) Explain WAP push architecture.

**Q5)** Attempt any Four of the following. **[16]**

- a) Differentiate between GPS & GPRS.
- b) Write a short note on core network.
- c) Explain the schemes of digital modulation.
- d) Explain limitations of IPV4 that overcome by IPV6.
- e) Explain the mechanism of dynamic source routing.



Total No. of Questions : 5]

SEAT No. :

P2830

[Total No. of Pages : 4

**[4837] - 303**  
**M.Sc. (Semester - III)**  
**COMPUTER SCIENCE**  
**CS - 303 : Soft Computing**  
**(2011 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates :-*

- 1) *All questions are compulsory.*
- 2) *Neat Diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Use of electronic pocket calculator is allowed.*

**Q1)** Attempt all.

**[8 × 2 = 16]**

- a) Define Fuzzy set.
- b) Define the linguistic hedge slightly for the linguistic atom:  $\alpha$ .
- c) State any two types of neural architectures.
- d) Find  $\underline{B} | \underline{A}$  for the following two fuzzy sets

$$\underline{A} = \left\{ \frac{1}{2} + \frac{0.5}{3} + \frac{0.3}{4} + \frac{0.2}{5} \right\}$$

$$\underline{B} = \left\{ \frac{0.5}{2} + \frac{0.7}{3} + \frac{0.2}{4} + \frac{0.4}{5} \right\}$$

- e) In genetic algorithm, what is meant search space.
- f) What is an epoch?
- g) State any two applications of genetic algorithm.
- h) What is the purpose of using a positive bias in a neural network?

**Q2)** Attempt any four.

**[4 × 4 = 16]**

- a) Differentiate between crisp set and fuzzy sets.
- b) Explain the McCulloh-Pitts Neuronal model. How is this model used to classify linearly separable pattern classes.

**P.T.O.**



- c) With the help of proper diagram, discuss briefly the various architectures of a neural network.
- d) Write a short note on aggregation of fuzzy rules.
- e) What is "crossover" in GA? Explain with the help of examples.

Q3) Attempt any four.

[4 × 4 = 16]

- a) Consider the following two fuzzy sets

$$\tilde{A} = \left\{ \frac{0.1}{x_1} + \frac{0.6}{x_2} + \frac{0.3}{x_3} + \frac{0.4}{x_4} \right\}$$

$$\tilde{B} = \left\{ \frac{0.5}{x_1} + \frac{0.2}{x_2} + \frac{0.8}{x_3} + \frac{0.9}{x_4} \right\}$$

Using Zadeh's notations, express the fuzzy sets into  $\lambda$  - cut sets for  $\lambda = 0.4$  &  $\lambda = 0.7$  for the following operations.

$$\left( \tilde{A} \cup \tilde{B} \right)_{0.5}, \quad \left( \overline{\tilde{A}} \cap \tilde{B} \right)_{0.8}$$

- b) Consider the following fuzzy sets

$$\tilde{P} = \left\{ \frac{1}{a} + \frac{0.3}{b} + \frac{0.1}{c} \right\}$$

$$\tilde{Q} = \left\{ \frac{0.5}{a} + \frac{1}{e} + \frac{0.5}{f} \right\}$$

$$\tilde{T} = \left\{ \frac{0.2}{p} + \frac{0.6}{q} + \frac{1}{r} \right\}$$

Perform the operations

$R = P \times Q$ ,  $S = Q \times T$  &  $T = R \bullet S$  on the fuzzy sets.

- c) Given the following two fuzzy sets

$$\tilde{\text{Small}} = \left\{ \frac{0.3}{p} + \frac{0.7}{q} + \frac{0.8}{r} + \frac{1}{s} + \frac{0.6}{t} \right\}$$

$$\tilde{\text{Large}} = \left\{ \frac{0.6}{p} + \frac{1}{q} + \frac{0.7}{r} + \frac{0.4}{r} + \frac{0.4}{s} + \frac{0.3}{t} \right\}$$

Find membership function for

- i) large or not small
- ii) not small and minus very large.

d) Consider the following two fuzzy sets defined on the universe

$$U_1 = U_2 = \{2, 3, 4, 5\}$$

$$\underline{2} = \left\{ \frac{1}{2} + \frac{.9}{3} + \frac{.6}{4} + \frac{.2}{5} \right\}$$

$$\underline{4} = \left\{ \frac{.4}{2} + \frac{.9}{3} + \frac{1}{4} + \frac{0.8}{5} \right\}$$

Using Zadeh's extension principle determine the membership values for the algebraic product  $\underline{4} \times \underline{2}$  & sum  $\underline{2} + \underline{2}$

e) Using the inference approach obtain the membership values for the triangular shapes (I & T) for a triangle with angles  $10^\circ$ ,  $60^\circ$  and  $110^\circ$ .

**Q4)** Attempt any two.

**[2 × 8 = 16]**

- a) Write a short note on Linguistic hedges.
- b) Briefly outline the operational summary of the BP algorithm.
- c) Explain how  $\alpha$ -LMS reduces the linear error at the output of neuron. What is the difference between  $\alpha$ -LMS &  $\mu$ -LMS.

**Q5)** Attempt any two.

**[2 × 8 = 16]**

- a) Develop a perceptron for the AND function with binary inputs and bipolar targets without bias upto 2 epochs. Initial weight = 0 and learning rate  $\eta = 1$ .

Input		Target
$X_1$	$X_2$	t
1	1	1
-1	1	-1
1	-1	-1
-1	-1	-1

Use following activation function

$$y = f(y_{-in}) = \begin{cases} 1 & \text{if } y_{-in} > 0 \\ 0 & \text{if } -0 \leq y_{-in} \leq 0 \\ -1 & \text{if } y_{-in} < -0 \end{cases}$$

- b) Let  $x = \{x_1, x_2, x_3\}$ ,  $y = \{y_1, y_2, y_3\}$  &  $z = \{z_1, z_2, z_3\}$  be the universe of discourse on which the following fuzzy sets be defined.

$$\tilde{A} = \left\{ \frac{1}{x_1} + \frac{0.5}{x_2} + \frac{0.4}{x_3} \right\}$$

$$\tilde{B} = \left\{ \frac{1}{y_1} + \frac{0.5}{y_2} + \frac{0.3}{y_3} \right\}$$

$$\tilde{C} = \left\{ \frac{0.1}{z_1} + \frac{0.6}{z_2} + \frac{1}{z_3} \right\}$$

Find

- i)  $A \times B = R$
  - ii)  $S = B \times C$
  - iii)  $T = \text{RoS}$  using max-min
- c) Maximize the following function where  $x$  is permitted to vary between 0 and 31 with initial population randomly selected is (11, 29, 8, 17) show one crossover operation and one mutation operation use the Roulette wheel selection method to select individuals that will participate in the crossover.

$$\text{Function} = f(x) = x^2 - 1$$

**XXXX**