2017-18
M.TECH. (WINTER SEMESTER) EXAMINATION
(COMPUTER ENGINEERING)
NUMERICAL AND STATISTICAL TECHNIQUES
(AM-661)

Maximum Marks: 60  Credits: 04  Duration: Two Hours

Answer all the questions.
Symbols and notations have their usual meaning.
The normal distribution table is attached.

Q.No.  Question  M.M.60

1(a)  Fit a curve of the form \( y = \alpha + b x^2 \) in the least square sense to the
function \( y = \sin x \) in the interval \((0, 1)\).

1(b)  For the initial value problem \( y'' + y' + xy = 0, y(0) = 1, y'(0) = 1 \), find
\( y(0.2) \) and \( y(0.3) \) by Modified Euler’s method.

2(a)  Consider \( 25 \frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}, \) with \( u(0,t) = 0, u(5,t) = 0; \frac{\partial u(x,0)}{\partial t} = 0, \)
\( u(x,0) = 2x \) for \( 0 \leq x \leq 2.5; \)
\( u(x,0) = 10 - 2x \) for \( 2.5 \leq x \leq 5 \)
Solve it by taking \( h = 1 \)

2(b)  Apply three iterations to find an approximate solution of the integral equation
\( y(t) = 1 + t + \int_0^t (t - s) y(s) ds, \quad y(0) = 1 \)

3  Answer any two parts.

(a)  Suppose that the joint pdf of the two-dimensional random variable \((X,Y)\) is
given by
\( f(x,y) = \frac{xy}{3} + x^2, \quad 0 \leq x \leq 1, \quad 0 \leq y \leq 2 \)
\( = 0, \quad \text{elsewhere} \)
Compute the following.
\( (i) \quad P(X<1/2) \)

\[ \text{Contd...} \]
(ii) \[ P(X < Y) \]
(iii) \[ P(X < 1/2 | Y < 1/2) \]

(b) A sample of size 5 is obtained from a random variable with distribution \[ N(12, 4). \]

(i) What is the probability that the sample mean exceeds 13?
(ii) What is the probability that the minimum of the sample is less than 10?
(iv) What is the probability that the maximum of the sample exceeds 15?

(c) Prove that \[-1 \leq \rho \leq 1\]

4 Answer any two parts.

(a) If the roots of \[ x^2 - ax + b = 0 \] are real and \( b \) is positive but otherwise unknown.

What is the expected value of the roots of the equation? Assume that \( b \) has a uniform distribution in the permissible range.

(b) Discuss one dimensional random walk (frog hopping). Calculate the probability \[ P_{X_k}(j) \] . Also calculate the probability \[ P[X_2 = 2, X_3 = 1] \].

(c) In a telegraph signal the Stochastic process is defined as:

\( x(t) = 1 \), if the total number of points in \((0,t)\) is even

\( x(t) = -1 \), if the total number of points in \((0,t)\) is odd

Let \( P(k) \) be the probability of getting \( k \) points in \((0,t)\) and

\[ P(k) = e^{-\lambda t} \frac{(\lambda t)^k}{k!}, k = 0, 1, 2, \ldots \]

Find \( E(x(t)) \).
### Table 1: \( (z \geq Z)d = np \frac{a-1}{1} \int f(z)\phi \) (Contd.)

<table>
<thead>
<tr>
<th>( z \geq Z )</th>
<th>Table 1</th>
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<tr>
<td>10.0</td>
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</table>

**Notes:**
- The table continues from the previous page.
- The values in the table represent cumulative probabilities.
- The table provides the probability that a standard normal variable exceeds a certain value.
Answer all questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question

1(a) Describe the Unified Process Model in detail.

1(b) Answer the following:
   i. How does the software development process resemble and differ from developing a manufactured product?
   ii. Why is software so expensive when there is little to no raw material required in developing it?
   iii. Why do we spend so much time and effort maintaining existing programs?

OR

1(b') Answer the following:
   i) Is software the only deliverable in a software project?
   ii) Can the software quality be assessed before the deployment?
   iii) Can we start with program construction phase in software development as soon as we get the requirements to ensure Time to delivery?

2(a) What are the differences between Size oriented Metrics and Function Oriented Metrics. Explain the advantages of one over other? How can we reconcile the two approaches to take advantages from both?

2(b) A company aims at creating a website for selling and buying used items online. Suggest a suitable process model for developing this website citing suitable reasons. Explain this process model.

OR

2(b') What are Function Points(FP)? Explain with a suitable example how to calculate FP.

3(a) Explain the different types of requirement analysis models?

3(b) Briefly explain different stages in collecting the Software Requirements.

OR
3(b') With regards to a Hostel management software that needs to be developed in a limited time frame of four weeks, present a detailed design using block diagrams. Do take care about the characteristics of a good Software Design.

4(a) With regards to a Hostel management software that needs to be developed in a limited time frame of four weeks, give a detailed analysis of what components you will test, few test cases in each category and an estimation of the time required for the testing.

4(b) Enumerate and explain Mandel’s golden rules of UI Design.

OR

4(b') Explain the following with examples
(i) Unit Testing
(ii) Integration Testing
(iii) Regression Testing
M.TECH. (AUTUMN SEMESTER) EXAMINATION
COMPUTER ENGINEERING
SELECTED TOPICS IN COMPUTER SYSTEMS
CO-602

Maximum Marks: 60
Credits: 04
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question                                      M.M.  
1(a)   An array contains n distinct elements \( a[1:n] \), write function(s) to readjust the elements of the array to form a heap with a time complexity of \( O(n) \). Also show the time complexity of the function(s) is \( O(n) \). [09]  
1(b)   Implement hashing using mod function as the hash function, discuss various ways through which collision and overflow is handled in the hash table. [06]  
2(a)   Given the node of a binary tree in C:-  
   struct node  
   {  
   int data;  
   struct node* left;  
   struct node* right;  
   };  
   Write a function in C to determine if the binary tree is a binary search tree or not. [09]  
2(b)   Design a divide and conquer algorithm which can multiply two matrices each of dimension \( n \times n \) in less than \( O(n^3) \) time. [06]  

OR

2'(a) Determine the best way to compute the matrix product \( M_1 \times M_2 \times M_3 \times \ldots \times M_q \) the dimensions of matrix \( M_i \) is \( r_i \times r_{i+1} \), using dynamic programming. Show the results for the example \( q = 5 \) and \( r = (10, 5, 1, 10, 2, 10) \). [09]  
2'(b) Discuss the greedy algorithm for single source all destination path with the help of a suitable example. [06]  

3(a) Discuss in detail the various mechanism through which IPC (interprocess communication) takes place. [09]  

Contd...
3(b) Discuss atomic hardware instructions provided by the modern machines for synchronization of critical section problem.

4(a) Discuss the multilevel queue scheduling and multilevel feedback queue scheduling with the help of a suitable example.

4(b) Design a solution to the critical section problem for two processes $P_0$ and $P_1$, using the variables turn and flag. The general structure of process $P_i$ is given below. The solution must satisfy mutual exclusion, progress and bounded waiting requirements.

```
do {
  entry section
  critical section
  exit section
  remainder section
} while(i);
```

OR

4'(a) Discuss the breath-first search and depth-first search graph searching algorithms with the help of a suitable example. Also calculate their time complexity.

4'(b) Solve the following recurrence equations

(i) $T(n) = T(n/3) + T(2n/3) + cn; T(1) = c$.
(ii) $T(n) = 2T(\sqrt{n}) + \log n$
Answer all the questions. 
Assume suitable data if missing. 
Notations used have their usual meaning.

Q.No.  Question                                      M.M.  
1      Write very brief answers for any FIVE of the following: [5x3]  
    i) Write three important limitations of Liquid Crystal Displays.  
    ii) What is the role of LEDs in LED Monitors/Televisions?  
    iii) What is retina display? Define Pixels Per Degree (PPD)  
    iv) Define Field of view of a camera  
    v) Possible role of Computer Graphics in security.  
    vi) What is Axonometric Projection?  
    vii) Representation of a Point and concept of Homogeneous Coordinates

2(a)   Derive representation of a plane in terms of (i) Points and (ii) Vectors and Point/s in Affine Space.  [07]  
2(b)   Derive Bresenham’s line drawing algorithm. How wide lines and different line styles can be implemented in this algorithm?  [08]  
2(b')  Determine the transformation that rotates an object by an angle θ in anti-clockwise direction about a line passing through origin and the point (3, 4, 5).  [08]  

OR

2(b’)  Determine the transformation that rotates an object by an angle θ in anti-clockwise direction about a line passing through origin and the point (3, 4, 5).  [08]  

3(a)   Determine and plot the perspective projection on xy plane of a Pyramid placed in +ve octant with its unit square base aligned with xz-plane and apex of unit height (Figure 1.) when the observer is at (i) (1,0,-1) and (ii) (1,0,-10)  [07]  

cont...
3(b) Give the blending function for drawing Bezier curves. Prove that the same can be drawn by De Casteljau's method employing four control points.

OR

3(b') Explain why Line clipping algorithm cannot be applied to clip polygons? What is the limitation of Sutherland and Hodgman Polygon clipping algorithm and how is it overcome through Weiler-Atherton Polygon clipping algorithm?

4(a) Describe Warnock's Area Coherence Algorithm for hidden surface removal. Apply this algorithm to the given polygons in Figure 2. and illustrate the solution.

4(b) List the properties of light sources and surfaces that affect shading? Explain Phong Illumination model.
2017-2018
M. Tech. 1st Semester Examination
(Computer Science and Engineering)
DIGITAL SYSTEM DESIGN (CO-623)

Maximum Marks: 60

- Attempt All questions.
- Symbols and notation used have their standard meanings.
- Assume suitable data if required.

1(a) Briefly describe Top-Down and Bottom-Up system design methodology. 6

(b) What are different levels of abstraction in the hierarchy, of structural domain? Give the 6
    flowchart of the digital system design flow.

OR

1'(a) Why the performance of the digital system is sacrificed to reduce the design cycle time? Explain 6
     the design flow with the help of flowchart.

(b) Explain with an example, how a three-input Look-up-Table of an FPGA CLB is used to design 6
    a three variable combinational system.

2(a) What is the design cycle time? Explain the concept of regularity in digital system design. 4

(b) The state diagram of an FSM is shown in figure 1. Design the digital system with minimum 8
    memory that satisfies the state diagram.

![State Diagram]

Figure 1

OR

2' The state diagram of a sequence detector is shown in figure 2. 12
    a. Determine the sequences detected by the machine.
    b. What type of machine does the state diagram represent?
    c. Minimize the number of states. Assign suitable codes to the states using
       Armstrong-Humphrey Rules.

contd... 2
3 (a) What is Type in VHDL? Write the VHDL code for a signal that is declared as a user defined type that can accept a 2-dimensional data.
(b) What are the different types of concurrent signal assignment statements in VHDL? Give the syntax of each type of statements
(c) List different VHDL operators according to their precedence.

4(a) Give the VHDL codes for a JK Flip Flop using Block and Guard statements with asynchronous resetting.
(b) Write a VHDL function for a 3-bit Majority Function. How this function is invoked in a VHDL code for designing a system?

5(a) What are Aliases and where it is used?
(b) Explain the meanings of:
   i. S'quite  
   ii. S'transaction
   iii. S'stable(T)
   S is a signal declared in VHDL
(c) Design a system with MUX as one of the components of the design that satisfies the given truth table and write down its VHDL codes.

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