University of Rajshahi

Department of Computer Science and Engineering

B. Sc. (Engg) Part-II Even Semester Examination 2020

Course: LAW 2211 (Cyber and Intellectual Property Law)

Full Marks: 35 Duration: 2 (Two) Hours

Answer 04 (Four) questions taking any 02 (Two) from each section

Section-A

1. a) What do you mean by "cyber space" and "intellectual property"? 2
   b) How does cyber law differ with traditional law? 2.5
   c) What is the nature of cyber law? Explain the importance of cyber law. 4.25

2. a) Enumerate the UNCITRAL model law on Electronic Commerce. 3
   b) Do you find any weakness of the ICT Act 2006? Explain. 2.75
   c) If any person obtain electronic signature from the authority who is not listed in the controller list and it is used for different purposes. Is it offence? If yes, then what will be the punishment according to the ICT Act 2006? 3

3. a) What is the quality control of digital forensic lab under Digital Security Act 2018? 2.75
   b) Suppose an employee has willingly modified source code to damage the code then what will be the punishment of the offence under the Digital Security Act 2018? 3
   c) Write down the functions of "Emergency Response Team". 3

Section-B

4. a) What do you mean by "Cyber Forensic"? 2
   b) Discuss the investigation process of cyber crime? 3.5
   c) Explain how you can recover digital evidence from browser log files. 3.25

5. a) According to ICT Act 2006, define electronic gazette, website and internet. 3
   b) How many days are fixed for delivering judgment of any cybercrime cases? 2
   c) What is cyber tribunal? Describe the trial procedure of Cyber Tribunal. 3.75

6. a) State the functions and objectives of WIPO. 2
   b) Who is an author of different works? Write about the owner of copyright. 3.75
   c) Suppose an employee is hired for making software for the software company but he/she sells the software without prior consent of the company who holds the copyright ownership. What will be the punishment of this offence according to the Copyright Act 2000? 3

University of Rajshahi

Department of Computer Science and Engineering

B. Sc. (Engg) Part-II Even Semester Examination 2020

Course: CSE 2231 (Computer Architecture and Organization)

Full Marks: 52.5 Duration: 3 (Three) Hours

Answer 06 (Six) questions taking any 03 (Three) from each section

Section-A

1.	a)	What is meant by 16-bit computer? Explain how operating system bridges the gap between software and hardware.	3.00
	b)	Define latency and throughput. Explain the factors influencing computer speed.	3.00
	c)	Suppose you have two processors A and B with clock period 5ns and 10ns respectively. On average 5.4 and 4.5 clock cycles are required to execute one instruction for A and B respectively. Compare the performance of the two processors.	2.75
2.	a)	Compare hardwired and microprogrammed controls. How PC works for branching instructions.	3.00
	b)	Explain instruction cycle with example.	3.00
	c)	Define addressing mode? Describe the instructions R1←M[B]+R3; R2←M[M[ADR]] + M[PC+H] with respect to addressing mode.	2.75
3.	a)	What is interrupt service routine? Compare vectored and non-vectored interrupts.	2.75
	b)	Discuss about different types of data manipulation instructions.	3.00
	c)	Explain I/O configuration with its proper block diagram.	3.00
4.	a)	Briefly describe the structure of a fixed point ALU with diagram.	3.00
	b)	Shortly discuss how a 16-bit bit-sliced ALU is designed by four 4-bit ALU slices.	3.00
	c)	Distinguish between Ripple-carry adder and Carry-lookahead adder with diagram.	2.75

Section-B

5.	a)	Discuss about program control instructions.	2.00
	b)	Suppose you have a CPU with only 3 registers connected as input through two multiplexers MUX A and MUX B. They are also connected as output through a multiplexer MUX D. The CPU supports only 4 instructions (ADD, SUB, MUL, DIV). Draw the register organization of the mentioned CPU and write the codewords of the instructions: R3←R2+R1; R1←R3-R2; R2←R1*R3.	3.75
	c)	Explain how pipelining improves the performance. Suppose you have a processor with 2.5GHz clock and 4 blocks for pipelining. You have a program with 3×10^5 instructions in which only 45% instructions can be executed through pipelining. Calculate speedup factor for pipelining.	3.00
6.	a)	Define peripherals with examples. Mention the requirements for I/O interface.	2.75
	b)	Compare synchronous and asynchronous data transfer scheme. Explain asynchronous data transfer system and mention its advantages.	3.00
	c)	Discuss about strobe-controlled data transfer system with necessary diagram.	3.00
7.	a)	Mention the advantages of DMA. Illustrate the steps of DMA transfer from I/O to memory.	3.00
	b)	Illustrate the function of virtual memory. Suppose your computer system needs 512B RAM and 512B ROM. Only the memory chips (RAM and ROM) of size 256B are available. Draw the diagram to illustrate the memory connection.	3.00
	c)	Explain the function of cache memory to speedup computer system? Consider that 420 of memory references are available in the cache out of 600. Calculate the cache performance.	2.75
8.	a)	Design a micro-programmed control unit based on Wilkes design.	4.00
	b)	Explain the concepts of interleaved memories.	2.75
	c)	Distinguish between CISC and RISC processors.	2.00

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engg. Part-II Even Semester Examination 2020
Course No : MATH2231 (Numerical Methods)
Marks: 35 Time: 2 Hours

(Answer any four questions taking at least two from each Section)

Section-A

1. (a) What are accuracy and precision? 1
   (b) Why do occur numerical errors? Explain different types of errors. 3
   (c) How can you measure absolute, relative and percentage errors? 3
   (d) Three approximate values of the number 1/3 are given as 0.30, 0.33 and 0.34. Which of these three is the best approximation? 1.75

2.(a) Describe the Bisection method for finding root of equation f(x)=0 with its merits and demerits 4.75
   (b) Find the real root of the equation $x^3-3x-5=0$ correct to three decimal places using Bisection method. 4

3. (a) Explain Shift Operator E, Average Operator μ and Differential Operator D used in interpolation formula. 1.5
   (b) Prove that $E = 1 + \Delta$, symbols have their ususal meaning. 2
   (c) Derive Newton's backward interpolation formula for equal spaced data. 3
   (d) Given the table 2.25

x	150	152	154	156
$y = \sqrt{x}$	12.247	12.329	12.410	12.490

Evaluate $\sqrt{155}$ using an interpolation formula.

Section-B

4. (a) What is curve fitting? Explain the purpose of it. 1.75
   (b) Describe the least square curve fitting procedure for power function $f(x) = ax^c$. 4
   (c) By the method of least squares, find a straight line that best fits the following data given in the table 3

x	0	1	2	3	4
y	1.0	2.9	4.8	6.7	8.6

5. (a) Explain Gauss elimination method to solve linear system of equations. 4.75
   (b) Solve the following equations using Gauss-Jordan method 4

$$x + y = 5$$
$$-2x - y + 2z = -10$$
$$3x + 6y + 7z = 14$$

6. (a) Derive Euler's method and modified Euler's method for solution of ordinary differential equations. 4.75
   (b) Solve the equation by Euler's method 4

$$\frac{dy}{dx} = y - x, \quad y(0) = \frac{1}{2}$$

Choose $h = 0.1$ and compute $y(0.2)$ and $y(0.4)$.

University of Rajshahi

Department of Computer Science and Engineering

B.Sc. (Engg.) Examination-2020, Part-2, Even Semester

Course: CSE2211 (Theory of Computation)

Full Marks-52.5 Time: 3 hours

[N.B. Answer any **SIX** questions taking **THREE** from each of the sections]

Section-A

1. a) Define alphabet and string. Explain the operation of string. 2.75
   b) Construct DFAs for the following regular languages: 6
      i) {w ∈ {0, 1}*| w ending with '01'}
      ii) { w ∈ {0, 1}*| w is a binary number whose decimal equivalent is divisible by 3}
      iii) $\{a^m b^n c^l : m, n, l \geq 0\}$.

2. a) Define Finite Automata (FA). Show the features of FA with block diagram. 3
   b) Discuss the various operations of DFA. 1.75
   c) Construct a deterministic machine that accepts the string (say w) of language over {0,1} in which the no. of 0's of w is even and w is started with 01. 4

3. d) Convert an NFA to DFA for the language containing "all strings in {0, 1}* in which the 2nd symbol from the right hand side is 1". 4
   e) Given a regular expression a(b|c)*|a. Convert it to an ε-NFA using Thomson construction. Then convert the ε-NFA directly to DFA. 4.75

4. a) Define Mealy machine by 6-tuple. Give an example with state table and state diagram. 3
   b) Construct a Mealy machine that accepts the language consisting of strings over {a,b} and string should be ending with either 'aa' or 'bb'. Print '1' if the input string is ending with either 'aa' or 'bb', otherwise print '0'. 3
   c) Convert the above Mealy machine to Moore machine. 2.75

Section-B

5. a) What is Computation? Briefly discuss the evolution of Theory of Computation. 3.75
   b) Write down applications of theory of computation. 2.5
   c) Why FA cannot recognize other than regular languages? Explain with example. 2.5

6. a) Construct a CFG to generate even and odd set of palindromes over alphabet {a,b}. 4
   b) Does a pushdown automaton (PDA) have memory? Justify. 1.75
   c) Write and explain the algorithm for minimization of a DFA. 3

7. a) What is an instantaneous description of a PDA? How will you represent it? 2.75
   b) Find PDA that accept the given CFG: 3
      i) S → XaaX ii) X → aX|bX|ϵ
   c) Construct PDAs for the languages: 3
      i) $\{a^n b^m a^{n+m} | \ m, n \geq 1\}$ ii) $\{a^n b^{2n} c^m | \ m, n \geq 1\}$.

8. a) Define Turing machine (TM). Differentiate between TM and PDA. 2
   b) Construct a Turing machine accepting the following language: i){w ∈ {a, b}*| w is consist of even number of a's and odd number of b's}, ii) $\{a^n b^n c^m | \ m, n \geq 1\}$. 6.75

University of Rajshahi

Department of Computer Science and Engineering

B. Sc. (Engg) Part-II Even Semester Examination 2020

Course: CSE 2221 (Design and Analysis of Algorithms)

Full Marks: 52.5 Duration: 3 (Three) Hours

Answer 06 (Six) questions taking any 03 (Three) from each section

Section-A

1. a) What are the steps required for algorithm design? 2.00
   b) What is the smallest value of n such that an algorithm whose running time is $100n^2$ runs faster than an algorithm whose running time is 2^n on the same machine? 3.00
   c) There is an image of $n \times m$ pixels. Originally all are white, but then a few black pixels are drawn. How can you determine the size of each white connected component in the final image? 3.75

2. a) Give an example of cumulative sum. 1.75
   b) Which method is faster for finding cumulative sum and why? 3.50
   c) A number n is given. Your task is to determine the row and column number of that given number in the table. Where n is less than or equal to 10^{15}. A sample table is given for only 16 numbers. 3.50

10	11	12	13
9	8	7	14
2	3	6	15
1	4	5	16

3. a) How can you find out the time complexity of merge sort algorithm? 2.75
   b) Is it possible to have $O(N + n)$ time complexity for sorting some numbers? If possible, write down the procedure? 3.00
   c) Find out the time complexity of the following two functions. 3.00

```
void f(int n)
{
    if(n == 1) return;
    f(n-1);
}

void g(int n)
{
    if(n == 1) return;
    g(n-1);
    g(n-1);
}
```

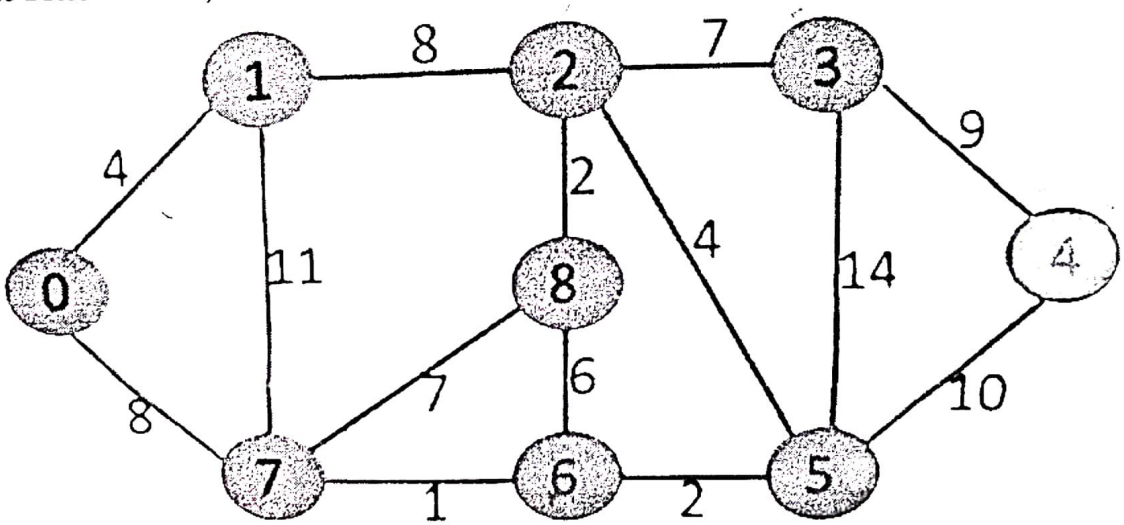
4. a) How can you create a graph using STL? 2.75
   b) An un-weighted and undirected graph and two nodes in a graph are given. How can you find the minimum distance between the nodes? Is it possible to find the minimum distance using DFS algorithm? 3.00
   c) How can you find out the time complexity of dynamic programming problem? 3.00

Section-B

5. a) Write the algorithm for DFS and analyze its complexity. 2.75
   b) How backtracking can be used to solve N-queens problem. 3.00
   c) What is a Hamiltonian Cycle? Explain how to find Hamiltonian path and cycle using backtracking algorithm. 3.00

6. a) Given a set of non-negative integers $(3, 34, 4, 12, 5, 8)$ and a value sum (9), determine if there is a subset of the given set with sum equal to the given sum. Show all the steps. 3.00
   b) Discuss two efficient algorithms for finding subset sum. 4.00
   c) Determine the time complexity of the two efficient algorithms? 1.75

7. a) Find a shortest path from 0 to 4 in the following graph. Show all the steps. Priority queue and set can be used for implementing the Dijkstra's shortest path algorithm. Which one is better and why? 6.00



   b) Why does Dijkstra's algorithm not solve the single source shortest-path problem on a weighted directed graph having negative weight edges? Explain with an example. 2.75

8. a) How can you build a segment tree for an input array $\{1,3,5,7,9,11,13\}$? 3.00
   b) What is articulation edge? How can you find out an articulation edge? 3.00
   c) Explain implicit graph with an example. 2.75

University of Rajshahi

Department of Computer Science and Engineering

B. Sc. (Engg) Part-II Even Semester Examination 2020

Course: MATH 2241 (Linear Algebra)

Full Marks: 52.5 Duration: 3 (Three) Hours

Answer 06 (Six) questions taking any 03 (Three) from each section

Section-A

1. a) Define a vector in $\mathbb{R}^n$. What do you mean by linear combination of vectors in $\mathbb{R}^n$? 3

   b) Consider the system of linear equations 3

   $$x - 2y = 2$$
   $$2x - 4y = -2$$

   Draw row picture and column picture, and explain the solution of the system of the linear equations based on the pictures.

   c) Find a unit vector u in the direction of $v = (3, 4)$. Find a unit vector w that is perpendicular to u. How many possibilities for w? 2.75

2. a) Define a *vector space*. Let H be the set of all vectors of the form $(a - 3b, b - a, a, b)$, where a and b are arbitrary scalars. Show that H is a subspace of $\mathbb{R}^4$. 3.75

   b) Define *Null space*. Find a spanning set for the null space of the matrix 3

   $$A = \begin{bmatrix} -3 & 6 & -1 & 1 & -7 \\ 1 & -2 & 2 & 3 & -1 \\ 2 & -4 & 5 & 8 & -4 \end{bmatrix}.$$

   c) Let $A = \begin{bmatrix} 2 & 4 & -2 & 1 \\ -2 & -5 & 7 & 3 \\ 3 & 7 & -8 & 6 \end{bmatrix}$ and $u = (3, -2, -1, 0)$. 2

   Determine if u is in $Nul\ A$. Could u be in $Col\ A$?

3. a) What do you mean by linearly dependent and linearly independent set of vectors? Define basis for a vector subspace H. 2

   b) Consider figure 3(a) and let $H = \text{Span}\{u, v, w\}$ and $w = u + v$. 3.75

   Show that $\text{Span}\{u, v, w\} = \text{Span}\{u, v\}$. Then find a basis for the subspace H.

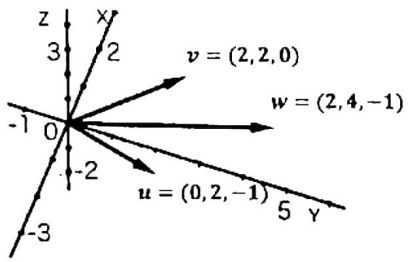


Figure - 3(a)

   c) Let $u = (2, 1)$, $v = (-1, 1)$, $x = (4, 5)$, and $\mathcal{B} = \{u, v\}$. Find the coordinate vector $[x]_{\mathcal{B}}$ of x relative to $\mathcal{B}$. 2

   d) Let $v_1 = (1, -2, 2)$ and $v_2 = (-3, 7, -8)$. Is $\{v_1, v_2\}$ a basis for $\mathbb{R}^2$? 1

4. a) Consider the bases $\{e_1 = (1,0),\ e_2 = (0,1)\}$ and $\{f_1 = (1,3),\ f_2 = (2,5)\}$ of $\mathbb{R}^2$. 2.25+3
   (i) Find the transition matrix P from $\{e_i\}$ to $\{f_i\}$.
   (ii) Show that $[T]_f = P^{-1}[T]_e P$ for the linear operator T on $\mathbb{R}^2$ defined by $T(x,y) = (2y, 3x - y)$.

   b) Let T be the linear operator on $\mathbb{R}^2$ defined by $T(x,y) = (4x - 2y, 2x + y)$. 3.5
   Verify that $[T]_f[v]_f = [T(v)]_f$ for any vector $v \in \mathbb{R}^2$.

Section-B

5. a) Consider figure 5(a). Is v an eigenvector of the matrix A ? 1

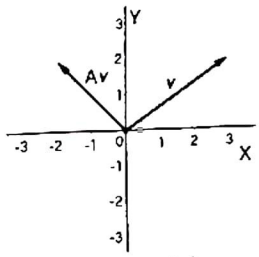


Figure- 5(a)

   b) Show that 7 is an eigenvalue of matrix $A = \begin{bmatrix} 1 & 6 \\ 5 & 2 \end{bmatrix}$, and find the corresponding eigenvectors. 3.75

   c) Prove that the set $\{v_1, v_2, \ldots\ldots, v_r\}$ is linearly independent where $v_1, v_2, \ldots\ldots, v_r$ are eigenvectors that correspond to distinct eigenvalues $\lambda_1, \lambda_2, \ldots\ldots, \lambda_r$ of an $n \times n$ matrix A. 4

6. a) Define ***similarity*** of two matrices. Prove that two $n \times n$ ***similar*** matrices A and B have the same characteristic polynomial and hence the same eigenvalues. 3

   b) Let $A = \begin{bmatrix} 7 & 2 \\ -4 & 1 \end{bmatrix}$. Find a formula for A^k, given that $A = PDP^{-1}$, 3.75
   where $P = \begin{bmatrix} 1 & 1 \\ -1 & -2 \end{bmatrix}$ and $D = \begin{bmatrix} 5 & 0 \\ 0 & 3 \end{bmatrix}$.

   c) Suppose A is a 2×2 matrix. One eigenvalue of A is $\lambda_1 = 0.8 - 0.6i$ and its corresponding eigenvector $v_1 = (-2 - 4i, 5)$. Find another eigenvalue and its corresponding eigenvector. 2

7. a) Define inner product of two vectors and length of a vector. 1

   b) Let W be the subspace of $\mathbb{R}^2$ spanned by $x = \left(\frac{2}{3}, 1\right)$. Find a unit vector z that is a basis for W. 2

   c) The set $S = \{u_1, u_2, u_3\}$ is an orthogonal basis for $\mathbb{R}^3$, where $u_1 = (3,1,1)$, $u_2 = (-1,2,1)$ and $u_3 = \left(-\frac{1}{2}, -2, \frac{7}{2}\right)$. Express the vector $y = (6,1,-8)$ as a linear combination of the vectors in S. 3

   d) Let $u_1 = (2,5,-1)$, $u_2 = (-2,1,1)$, and $y = (1,2,3)$. Observe that $\{u_1, u_2\}$ is an orthogonal basis for $W = \text{Span}\{u_1, u_2\}$. Write y as the sum of a vector in W and a vector orthogonal to W. 2.75

8. a) Define an inner product space. State and prove Cauchy Schwartz inequality in an inner product space. 4.5

   b) Use Gram-Schmidt orthogonalization process to transform the basis 4.25
   $\{v_1 = (1,1,1), v_2 = (0,1,1), v_3 = (0,0,1)\}$ of $\mathbb{R}^3$ into an orthonormal basis $\{u_i\}$.