

Pabna University of Science & Technology
Department of Computer Science and Engineering
B.Sc. Engineering Examination 2nd Year 2nd Semester-2019
Course Title: Digital System
Course No: CSE -2205
Time: 3:00 hours (For PART-A and PART-B)

NB:

Full Marks: 35

- i. Answer any **three** questions.
- ii. Separate answer script must be used for answering the question of PART-A.
- iii. Figures in the right margin indicate marks.

PART-A

1. a) Briefly explain the differences between digital system and analog system with necessary example? 5.67
- b) Draw and define Universal gates with necessary truth table and explain why they called Universal gates? 06
2. a) Subtract the followings, 6
i) 1010-1111, ii) 11011-10101, iii) 0101-1001
- b) Simplify the following Boolean function, F with don't care function, d: 5.67
 $F(A,B,C,D)=\sum(0,1,2,4,6,8,11)$
 $d(A,B,C,D)=\sum(3,7,9,10,12)$
3. a) Draw a binary full adder and briefly explain with an example. 6.67
- b) Draw a BCD adder and describe how it works. 5
4. a) What is the truth table and logic symbol of a three-input OR gate? 1
- b) Explain how basic gates can be realized by NOR gates. Realize the function $F=A+BCD'$ using NAND gates only. 4.67
- c) Simplify the following expressions: $(A+B+C)(A+B'+C')(A+B+C)(A+B'+C)$ 3
- d) State and explain the basic Boolean logic operations. 3

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Time: 3:00 hours (For PART-A and PART-B)

NB:

Full Marks: 35

- i. Answer any **three** questions.
- ii. Separate answer script must be used for answering the question of **PART-B**.
- iii. Figures in the right margin indicate marks.

PART-B

1. a) What do you mean by Multiplexer? Draw and explain the operation of a basic Multiplexer. 6.67
b) Define Decoder. Draw and explain the operation of a decoder. 5
2. a) Draw the logic circuit that has the expression: $y = AB(\overline{C+D})$ 3.67
b) Simplify the following function to a minimum number of literals: $F = xz + x\bar{y}z$. 02
c) Convert the following function to other canonical form: $F(A, B, C, D) = \sum(0, 1, 2, 3, 4, 6, 12)$ 03
d) X_1X_0 represents a two-bit binary number that can have any value (00, 01, 10 or 11) for example, 03
when $X_1=1$ and $X_0=0$, the binary number is 10, and so on. Similarly Y_1Y_0 represents a two-bit binary number. Design a logic circuit using X_1 , X_0 , Y_1 and Y_0 inputs, whose output will be HIGH only when the two binary numbers X_1X_0 and Y_1Y_0 are equal.
3. a) What is the function of a clock in sequential circuit? 2.67
b) Briefly explain the operation of T and D flip-flop with necessary circuit and truth table. 9
4. a) Define and explain Sequential logic with necessary figures and example. 6.67
b) Draw and explain demultiplexer with necessary indications. 5

Pabna University of Science and Technology
Department of Computer Science and Engineering
 B.Sc. Engineering Examination 2nd Year 2nd Semester 2020
 Course Title: Algorithms
 Course No: CSE 2201

Time: 3:00 hours (For PART-A and PART-B)

PART-A

Full Mark:35

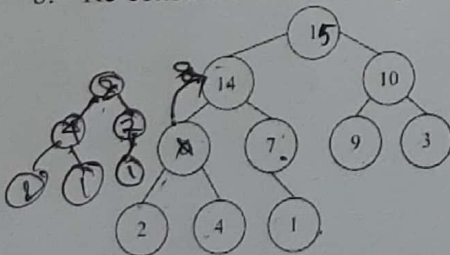
- N.B:
- Answer any **Three** questions.
 - Separate answer script must be used for answering the questions of PART-A.
 - Figures in the right margin indicate marks.

- Define *complexity* of algorithms. Describe *constant time*, *linear time* and *logarithmic time complexity* with example. $6\frac{2}{3}$
 - What is *space complexity* of an algorithm? Calculate the *space complexity* for the following procedure: 5

```

int Summation(int A[],int n)
{
    int sum=0;
    for(i=1;i<=n;i++)
    {
        sum=sum+A[i];
    }
    return sum;
}
  
```

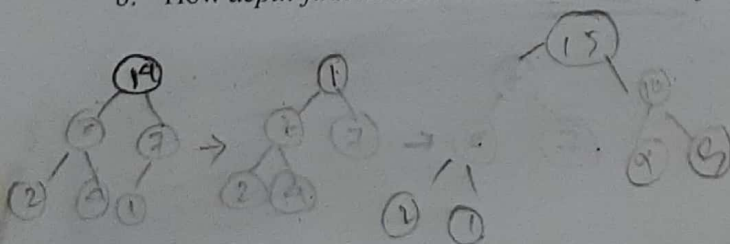
- Define *divide-and-conquer* strategy. 2
 - Write down the pseudo code for bucket sort. Write down applications for bucket sort. When bucket sort is used instead of counting sort. 5
 - Analyze the time complexity of *merge sort* algorithm. $4\frac{2}{3}$
- Illustrate the steps of *quick sort* to sort the following dataset in ascending order: {27, 5, 40, 45, 10, 20, 35, 32, 25, 12} $5\frac{2}{3}$
 - Re-construct the following *heap* when node 14 is deleted. 6



- Which sort technique is better to sort the following array list compare among (i) bubble (ii)merge (iii) insertion sort technique. 7

3	4	5	6	7	8
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- How *depth-first search* differs from *breadth-first search*? $4\frac{2}{3}$



PART-B

Full Mark: 35

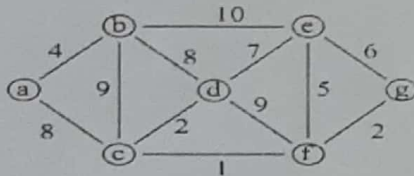
N.B:

- i. Answer any **Three** questions.
- ii. Separate answer script must be used for answering the questions of PART-B.
- iii. Figures in the right margin indicate marks.

1. a.

What do you understand by a *spanning tree*? Construct a *spanning tree* from the following graph using Prim's algorithm.

6 $\frac{2}{3}$



b. Write down the pseudo-code for Kruskal's algorithm.

5

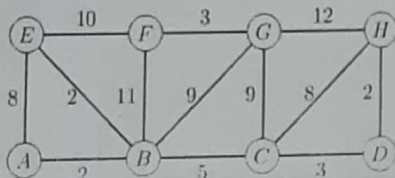
2. a.

How Matrix Chain Multiplication (MCM) works? Write down the algorithms for MCM..

5 $\frac{2}{3}$

b. Run Dijkstra's algorithm on the weighted graph below, using vertex A as the source. Write the vertices in the order which they are marked.

6



3. a.

What do you mean by dynamic programming? Write down usages of dynamic programming. Write down the practical example of dynamic programming.

6 $\frac{2}{3}$

b. A thief went to a shop to steal. He wants to take products so that profit would be maximized. Find an optimal solution using fractional knapsack problem for the following specifications.

5

Number of products in the shop = 6
Knapsack capacity = 18 kg

Item	Weight (kg)	Profit (Tk)
p-1	8	28
p-2	4	16
p-3	1	3
p-4	7	28
p-5	6	12
p-6	2	4

4. a.

Write a short note on *greedy algorithms*. Why *knapsack* problem is called a greedy algorithm?

5 $\frac{2}{3}$

b. Suppose you want to design a Dictionary word search system. Calculate the complexity of using linear search, index search and which one is better.

6

Pabna University of Science and Technology
Department of Computer Science and Engineering
 B.Sc. Engineering Examination 2nd Year 2nd Semester-2020
 Course Title: Theory of Computation
 Course No: CSE-2203
 Time: 3:00 hours (For PART-A and PART-B)

PART-A

Marks 35

- N.B:
- i. Answer any **Three** questions.
 - ii. Separate answer script must be used for answering the questions of PART-A.
 - iii. Figures in the right margin indicate marks.

1. a. Differentiate among Complexity theory, Computability theory and Automata theory. 3
- b. Describe the application of Automata Theory in Computer Science. $4\frac{2}{3}$
- c. Define empty string and powers of an alphabet. Suppose set of alphabet, $\Sigma = \{0, 1\}$. Find out length of string consisting of binary representation of 17 and also find Σ^3 . 4
2. a. Describe about formal definition of Deterministic Finite Automata and Non-deterministic finite automata. Also write down differences between Deterministic Finite Automata and Non-deterministic finite automata. $5\frac{2}{3}$
- ~~2.~~ b. What is transition diagram? Draw a transition diagram of an FA that accepts all strings of 0's and 1's in which both the number of 0's and number of 1's are even. 6
3. a. Show that the class of regular languages is closed under the regular operations 5
- b. Construct an NFA over the alphabet $\Sigma = \{0, 1\}$ that accepts the set of strings that contain an odd number of occurrences of substring 011. Then convert this NFA to an equivalent DFA. $6\frac{2}{3}$
4. a. Consider the following context free grammar G:
 $S \rightarrow XRX \mid R$
 $R \rightarrow aTb \mid bTa$
 $T \rightarrow XTX \mid X \mid \epsilon$
 $X \rightarrow a \mid b$
 Now answer all the following questions:
 (i) What are the variables of G?
 (ii) What are the terminals of G?
 (iii) Which is the start variable of G?
 (iv) Check whether G generates the string 'aaaabbb' and if it does, also draw the parse tree. 6
- b. Prove that, regular languages are context free. $5\frac{2}{3}$

$$\begin{array}{r} 16 \quad 8 \quad 4 \quad 2 \quad 1 \\ \hline 1 \quad 0 \quad 0 \quad 1 \end{array}$$

Pabna University of Science and Technology
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 B.Sc. Engineering Examination 2nd Year 2nd Semester-2020
 Course Title: Theory of Computation
 Course No: CSE-2203
 Time: 3:00 hours (For PART-A and PART-B)

PART-B

Marks 35

- N.B:
- i. Answer any **Three** questions.
 - ii. Separate answer script must be used for answering the questions of PART-B.
 - iii. Figures in the right margin indicate marks.

1. a. State and prove the technique to determine a regular language. $6\frac{2}{3}$
 b. Prove that the language $A = \{0^n 1^n 2^n \mid n \geq 0\}$ is not regular by above technique. 5
2. a. Prove that class of regular languages is closed under 'concat' operation. $6\frac{2}{3}$
 b. Compute Regular Expressions for the following languages: 5
 - (i) $L = \{w \mid w \text{ begins with a 0 and ends with a 0}\}$.
 - (ii) $L = \{w \mid w \text{ has length at least 4 and its third symbol is a 1}\}$.
 - (iii) $L = \{w \mid w \text{ contains an odd number of 0's or exactly two 1's}\}$.
 - (iv) $L = \{w \mid w \text{ is any string except 111 and 1111}\}$.
 - (v) $L = \{w \mid w \text{ contains at least three 0's and at most one 1}\}$
3. a. Formally describe Chomsky Normal Form. What are the steps to convert a context free grammar to CNF? $3\frac{2}{3}$
 b. Consider a context free grammar as follows: 6

$S \rightarrow ASB \mid SC \mid BS$
 $A \rightarrow aBC \mid \epsilon$
 $B \rightarrow b \mid Ac \mid \epsilon$
 $C \rightarrow c$
 Convert it to CNF grammar.
4. a. Write down languages formed by the regular expression: $(a|b)^*$ and $(001 \mid 100)^3$. 2
 b. Design an NFA over the alphabet $L = \{a, b\}$ which accepts all and only the strings of nonzero length having nonzero odd number of a's at the end. Also design its equivalent Regular expression. $6\frac{2}{3}$
 c. Give example of an NP-hard problem in complexity theory. 3
 d. Draw a DFA for the regular expression $(10 \cup 11)^*$. 2

Pabna University of Science and Technology
Department of Computer Science and Engineering
 B.Sc. Engineering Examination 2nd Year 2nd Semester-2020
 Course Title: Complex Analysis, Laplace and Fourier Transformations
 Course No: MATH-2201

Time: 3:00 hours (For PART-A and PART-B)

$$\frac{dv}{du} \ln u = \frac{dv}{dy} \frac{dy}{du}$$

$$- \frac{dy}{du} \ln u + \frac{dv}{du} \frac{dy}{du}$$

$$+ \ln u + \frac{1}{2} \ln^2 u - \ln^3 u$$

$$+ \ln^2 u + - \ln^3 u$$

Handwritten notes:
 Problem 1
 Problem 2

PART-A

Marks 35

- N.B:
- i. Answer any **Three** questions.
 - ii. Separate answer script must be used for answering the questions of PART-A.
 - iii. Figures in the right margin indicate marks.

01. (a) What is complex number? If z_1 and z_2 be two complex numbers, then prove that (i) $\overline{z_1 - z_2} = \overline{z_1} - \overline{z_2}$, (ii) $|z_1 + z_2| \leq |z_1| + |z_2|$ (iii) $|z| \geq \operatorname{Re}(z)$. 6.67
 (b) Describe geometrically the region (i) $|z + 3i| \geq 4$, (ii) $|z - 4| \geq |z|$ 05
02. (a) Define limit and continuity. Using the definition of derivative find the derivative of the function $f(z) = z^3 + 2z^2 + i$ at $z = 2$. 4.67
 (b) What is singular point? Show that $\frac{d}{dz}(\bar{z})$ does not exist anywhere. 04
 (c) Show that the function $u = x^3 - 3xy^2$ is a harmonic function. Determine its harmonic conjugate. 03
03. (a) State and prove Cauchy-Reimann (C-R) theorem in polar form. 4.67
 (b) Verify that the Cauchy-Reimann (C-R) equations are satisfied for the functions (i) $f(z) = \cos 2z$, (ii) $f(z) = e^{z^2}$. 07
04. (a) State Cauchy's integral formula. Using Cauchy's evaluate $\int_c \frac{zdz}{(9-z^2)(z+i)}$, where c is the circle $|z| = 2$ describe in the positive sense. 04
 (b) Show that $\int_c \frac{e^{2z}}{(z+1)^4} dz = \frac{8\pi i e^{-2}}{3}$, where c is the circle $|z| = 3$. 04
 (c) Evaluate $\int_c \frac{4-3z}{z(z-1)(z-2)} dz$, where c is the circle $|z| = \frac{3}{2}$. 3.67

Pabna University of Science and Technology
Department of Computer Science and Engineering
 B.Sc. Engineering Examination 2nd Year 2nd Semester-2020
 Course Title: Complex Analysis, Laplace and Fourier Transformations
 Course No: MATH-2201
 Time: 3:00 hours (For PART-A and PART-B)

PART-B	Marks 35
N.B: i. Answer any Three questions. ii. Separate answer script must be used for answering the questions of PART-B. iii. Figures in the right margin indicate marks.	

01. (a) If $L\{F(t)\} = f(s)$, then show that $L\left[\int_0^t F(u)du\right] = \frac{f(s)}{s}$. 03
- (b) If $L\{F(t)\} = f(s)$, then prove that $L\{F'''(t)\} = s^3 f(s) - s^2 F(0) - sF'(0) - F''(0)$. 04
- (c) Define Laplace transformation. Find $L\{t^2 e^{2t} + e^t \sin 2t - t^2 \cos 2t\}$ 4.67
02. (a) What is inverse Laplace transform? Find (i) $L^{-1}\left\{\frac{1}{s^3(s^2+1)}\right\}$, (ii) $L^{-1}\left\{\frac{8s+20}{s^2-12s+32}\right\}$ 07
- (b) Solve the ODE by using Laplace transformation $Y''(t) + 9Y(t) = \cos 2t$; $Y(0) = 1$, $Y\left(\frac{\pi}{2}\right) = -1$. 4.67
03. (a) Define Fourier cosine and sine series. Find the coefficient values of a_0, a_n and b_n for even function. 5.67
- (b) Find the Fourier series expansion of the function $f(x) = \begin{cases} 0, & -\pi < x \leq 0 \\ x, & 0 < x \leq \pi \end{cases}$. Hence evaluate the sum $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$. 06
04. (a) Find the Fourier series expansion of the function $f(x) = |x|$ in the interval $[-\pi, \pi]$. Hence evaluate the sum $\sum_{n=0}^{\infty} \frac{1}{(2n+1)^2}$. 5.67
- (b) Find the series of sine and cosine of multiples of x which represents $f(x)$ in the interval $-\pi \leq x \leq \pi$ where $f(x) = \begin{cases} 0, & -\pi < x \leq 0 \\ \frac{\pi x}{4}, & 0 < x \leq \pi \end{cases}$ and deduce that $\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \dots$ 06

Pabna University of Science and Technology
Department of Computer Science and Engineering
 B. Sc. Engineering 2nd Year 2nd Semester Examination-2019
 Course Title: Theory of Statistics
 Course No: STAT 2201
 Time: 3:00 hours (For PART-A and PART-B)

PART-A

- N.B:
- i. Answer any **Three** questions.
 - ii. Separate answer script must be used for answering the questions of PART-A.
 - iii. Figures in the right margin indicate marks.

1.
 - a. Define degrees of freedom with an example 2
 - b. Find the moment generating function of a chi-square variate with k degrees of freedom. Hence, find the mean and variance of that variate. 6
 - c. Write the properties and application of a chi-square distribution. 3
 $\frac{2}{3}$
2.
 - a. What is central limit theorem? 2
 - b. The service times for the customers coming through a checkout counter in a retail store are independent random variables with mean of 1.5 minutes and variance of 1. Approximate the probability that 100 customers can be serviced in less than 2 hours of total service time. Also, comment on your result. 3
 $\frac{2}{3}$
 - c. Define F and t statistic. Show that the distribution of t-statistic tends to the standard normal distribution as the sample size tends to infinity. 6
3.
 - a. What are the differences between estimator and statistic? Write the criteria of a good estimator? 4
 - b. Let $x_1, x_2, x_3, \dots, x_n$ be a random variable from a normal distribution with mean μ and variance 4. Show that \bar{x} is an unbiased and consistent estimator of μ . 5
 - c. Define efficiency, Cramer-Rao lower bound, sampling distribution. 2
 $\frac{2}{3}$
4.
 - a. What are the different methods of finding point estimator? Describe the maximum likelihood method of finding a point estimator. 3
 $\frac{2}{3}$
 - b. Let $x_1, x_2, x_3, \dots, x_n$ be a random sample of size n from a normal distribution with mean μ and variance σ^2 . Find the maximum likelihood estimators (MLEs) of μ and σ^2 ? Is the MLE of σ^2 unbiased? Consistent? Efficient? 8

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 B. Sc. Engineering 2nd Year 2nd Semester Examination-2019
 Course Title: Theory of Statistics
 Course No: STAT 2201
 Time: 3:00 hours (For PART-A and PART-B)

PART-B

- N.B:
- iv. Answer any **Three** questions.
 - v. Separate answer script must be used for answering the questions of PART-B.
 - vi. Figures in the right margin indicate marks.

1. a. Define order statistic with example. Let odd number of random samples $x_1, x_2, x_3, \dots, x_n$ is drawn from a population with density function $f(x) = \frac{x}{8}, 0 < x < 4$. Find the distribution of the median of the random sample. 6
- b. Find the distribution of the range of a random sample $x_1, x_2, x_3, \dots, x_n$ with density function $f(x)dx = -\infty < x < \infty$. 5 $\frac{2}{3}$
2. a. Define the following terms with example 7
 - (i) Null hypothesis (ii) Alternative hypothesis (iii) Test statistic (iv) Probability of the type one error (v) Power of test (vi) Critical region (vii) Level of significance
- b. The mean and standard deviation of scores obtained from a random sample of 40 students at a college were 2.8 and 0.40 respectively. Can you conclude that that the sample has come from the entire group of students, which has mean score of 2.5. Use a 5% level of significance. 4 $\frac{2}{3}$
3. a. Describe the procedure of testing a hypothesis. 2 $\frac{2}{3}$
- b. What do you mean by p-value and confidence interval? 2
- c. The sample data show that 120 adult males born in rural area have a mean height of 62 inches with a standard deviation of 2.50 inches, and 140 adult males born in the urban area have a mean height of 61.5 inches with a standard deviation of 2.60 inches. Test the hypothesis that the mean heights in the two areas from which the samples have been drawn do not differ. Compute also the 95% confidence interval for the difference in population mean and interpret. 6
4. a. Define non-parametric test. What does it differ to parametric test? 2 $\frac{2}{3}$
- b. Describe test a hypothesis about a median using the sign test. 3
- c. A consumer test to determine the preference for decaffeinated versus regular coffee. Use the 0.10 significance level. The null and alternate hypothesis are: 5

$H_0: \pi=0.50 \quad n=12$
 $H_1: \pi \neq 0.50$

 - (i) Is this a one-tailed or a two-tailed test hypothesis?
 - (ii) Show the decision rule in a chart.
 - (iii) Letting consumer preference for decaffeinated coffee be a "+" and preference for regular coffee a "-", it was found that two customers preferred decaffeinated. What is your decision? Explain.