Bangabandhu Sheikh Mujibur Rahman Science and Technology University

Department of Computer Science and Engineering
Course No: STA154 Course Title: Statistics for Engineers
1st Year 2nd Semester Examination- 2016

Marks: 60 Time: 3 Hours

[All questions are of equal value. Answer **Six** questions taking any **Three** from each section. Digit of the right side margin indicates marks.]

Section A

1. a) What do you mean by variable? Identify the following variables as qualitative or quantitative, if quantitative then classify as discrete or continuous. 4
   i. Gender of a software engineer
   ii. Number of errors in a C-program.
   iii. Temperature of an organic reaction.
   iv. Lifetime of an electric bulb.
   v. Monthly salary of an IT officer.
   vi. Religion of a teacher.
   b) What is frequency distribution? State important steps for constructing a frequency distribution of a continuous data. 4
   c) Distinguish between histogram and bar diagram. 2

2. a) What do you mean by central tendency? What are the different measures of central tendency? 2
   b) For 2 positive observations, prove that $AM \geq GM \geq HM$. When does the equality hold? 4
   c) Show that arithmetic mean is dependent on both origin and scale. 4

3. a) What do you mean by dispersion? 1
   b) Describe different absolute measures of dispersion. 4
   c) Suppose that the following data gives the weight (in kg) of 10 students. 5

   48 51 57 52 63 52 50 51 53 59

   Calculate the standard deviation of the weights.

4. a) Define correlation coefficient. Give interpretations for the different values of the correlation coefficient. 3
   b) For two unequal observations, prove that $MD = SD = R/2$, where MD =mean deviation about mean, SD =standard deviation and R =Range. 4
   c) What are the differences between correlation and regression? 3

Section B

5. a) Define random experiment, event, favourable outcomes and equally likely outcomes. 2
   b) Let A and B be two events with $P(A) = 0.25, P(B) = 0.40, and\ P(AB) = 0.15$. Find 4
   i) $P(A^c)$, ii) $P(A \cup B)$, iii) $P(A^c \cap B^c)$ and iv) $P(A^c \cap B)$
   c) The probability that a contractor will get a plumbing contract is $2/3$, and the probability that he will not get an electric contract is $5/9$. If the probability of getting at least one contract is $4/5$, what is the probability that he will get both? 4

6. a) Define conditional probability. In a city 55% of the population is male. It is known that 20% of the male and 30% of the female is unemployed .A research student studying the employment situation selects a person at random, find the probability that the student is a male given that he is unemployed. 5
   b) State the Bays theorem. A fan assembler uses motors from two suppliers. Company A supplies 60% and company B supplies the rest. It is known from previous experiences that 2% of the motors supplied by company A are defective and 3% of the motors supplied by company B are defective. An assembler fan is found to have a defective motor, what is the probability that company A supplied this motor? 5

7. a) What do you mean by random variable, probability mass function and probability density function? 3
   b) A random variable X has the following probability function: 4

x	0	1	2	3	4	5	6	7	8
$P(x)$	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

   i) Determine the value of a.
   ii) Find $P(X < 3), P(X \leq 3), and\ P(0 < X < 5.)$
   c) Define binomial distribution. Find the mean of binomial distribution. 3

8. a) What do you mean by expectation of a function of a random variable? 1
   b) If X is random variable with expectation $E(X)$, then for any numerical constants a and b, prove that $E(aX + b) = aE(X) + b$. 3
   c) Let X be a random variable with the following density function 6

$$f(x) = \frac{1}{9}(4x - x^2), 1 < x < 4.$$

Find $E(X), E(X - 1), E(X^2), E(3X + 2)$.

Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science & Engineering
1st Year 2nd Semester B.Sc. Engineering Examination-2016

Course No: EEE156 Course Title: Electronic Devices and Circuits
Full Marks: 70 Time: 3 hours

N.B.
i) Answer **SIX** questions, taking any **THREE** from each section.
ii) All questions are of equal values.
iii) Use separate answer script for each section.

SECTION-A

Q.1 (a) What is Half Wave rectifier? Draw the corresponding circuit diagram for a Half wave rectifier. 2
(b) Describe the operation of a Full wave bridge rectifier with proper input and output signals. 4.67
(c) What is filter circuit? Explain the operation of capacitor and π filter circuit with appropriate figures. 5

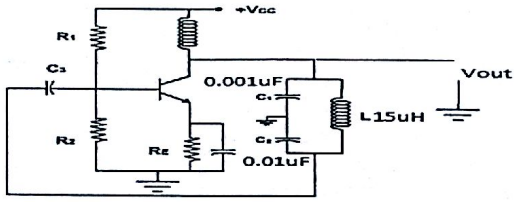
Q.2 (a) What is Zener diode and Zener voltage? Explain the operation of Zener diode for voltage stabilization 4
(b) A full wave rectifier uses two diodes, the internal resistance of each diode may be assumed at 20Ω. The transformer *rms* secondary voltage from center tap to each end of secondary is 50V and the load resistance is 980Ω find (i) the mean load current (ii) the *rms* value of load current. 5
(c) What is choke filter? Draw its circuit diagram with corresponding input and output. 2.67

Q.3 (a) What is an OP-AMP? Draw its diagram and describe its terminals. 2
(b) What are the characteristics of an ideal OP-AMP? What do you mean by virtual ground? Why V_i is reduced to almost zero? 4
(c) How does OP-AMP perform as Inverting and Non-Inverting amplifier? Give description. 5.67

Q.4 (a) Explain the contribution of donor and acceptor impurities for formation of n-type and p-type semiconductors respectively with the appropriate diagram. 2+3
(b) What is hole? Describe the mechanism of hole current flow in a semiconductor. 1+2
(c) Write down the name of the control element for semiconductor devices. How it works as a switch, explain briefly. 3.67

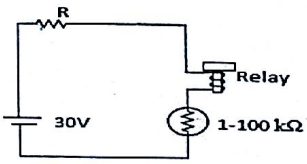
SECTION-B

Q.5 (a) What is an oscillatory circuit? What do you mean by damp and undamp oscillation? 2
(b) Explain the operation of a Colpitts oscillator with proper diagram 4.67
(c) Determine the (i) operating frequency and (ii) feedback fraction for the following oscillator. 5



Q.6 (a) Write down the basic operation of LED according to the graph Light output vs Forward current 2.67
(b) What is LCD? How a digit is showed in LCD as a segment 1+3
(c) Explain the operation of photodiode with figure. How can you use photodiode as a dust sensor? 3+2

Q.7 (a) What is photoconductive cell? Explain its operation through the plot drawn as cell resistance vs illumination. 3.67
(b) A relay is controlled by a photoconductive cell which has resistance of 100 kΩ when illuminated and 1 kΩ when in the dark. The relay is supplied with 10 mA from a 30-V supply when cell is illuminated and is required to be de-energized when the cell is in the dark. Sketch a suitable circuit and calculate the required series resistance and value of dark current. 5



(c) What is photovoltaic cell? Explain the operation of laser diode as a range finder. 1+2

Q.8 (a) Derive the relation between current amplification factor (α) and base current amplification factor (β). Also deduce the collector current equation in case of common emitter connection transistor. 2+2
(b) For a transistor, β = 45 and voltage drop across 1 kΩ which is connected in the collector circuit is 1 volt. Find the base current for common emitter connection. 4
(c) Why is collector current slightly less than emitter current? 3.67

Bangabandhu Sheikh Mujibur Rahman Science & Technology University
Department of Computer Science and Engineering
1st Year 2nd Semester B.Sc. (Engg.) Final Examination-2016

Course No.:CSE150 **Course Title: Data Structure**
Full Marks: 60 **Time: 03 hours**

N.B.
i) Answer **SIX** questions taking any **THREE** from each Section
ii) All questions are of equal values.
iii) Use separate answer script for each section

Section-A

1. a) Write down the resulting string. 4
   i) SUBSTRING ('DO BEFORE YOU DIE', 3, 11) =?
   ii) Suppose T= 'THEY ARE PROUD OF THEIR MOTHERLAND'. Find,
   INDEX (T,' THE') =? , INDEX (T, 'THE') =?
   iii) REPLACE ('XABYABP', 'BA', 'C') =?
   b) Which operations are mostly used in linear data structures? Explain the each one. 4
   c) Compare between Big-O and Big-Ω in two points. 2

2. a) Explain the complexity C(n) of the following algorithms, where T and P are text and pattern with lengths T_LEN and P_LEN respectively, and stored as arrays with one character per element. 3

   Algorithm :
   1. Set K := 1 and MAX := T_LEN – P_LEN + 1.
   2. Repeat Steps 3 to 5 while K <= MAX:
   3. Repeat for L = 1 to P_LEN:
      If P[L] != T[K + L – 1], then: Go to Step 5.
   [End of inner loop.]
   4. Set INDEX:= K, and Exit.
   5. Set K := K + 1.
   [End of Step 2 outer loop.]
   6. Set INDEX:=0.
   7. Exit.

   b) Write the Bubble sort algorithm for the given data with n elements. What is the complexity of this algorithm? 5
   c) Distinguish between Linear search algorithm and Binary search algorithm? 2

3. a) Define priority queue. 1
   b) Write an algorithm to insert a node at beginning & end position of a circular linked list. 3
   c) Consider the following arithmetic infix expression Q: 4

   Q: A + (B * C - (D / E ^ F) * G) * H.

   Transform Q into its equivalent postfix expression P.
   d) What do you mean by garbage collection? Define Overflow and Underflow. 2

4. a) Explain the two way linked list. How it solves the problem of one way linked list? 4
   b) Give three real time examples in each case where the concept of *Stack* and *Queue* are used. 2
   c) What are the three basic steps to solve the *Tower of Hanoi* problem, recursively? 2
   d) What is Recursion? Write a program to generate Fibonacci series using recursion. 2

Section-B

5. a) Write the procedure to delete an **ITEM** from a *Queue*. 4
   b) Evaluate the following *Postfix* expression P, using the desired algorithm- 6
   P: 12, 7, 3, -, /, 2, 5, 1, -, *, +

6. a) Consider a binary tree T (**Fig-1**). Now insert a new item 14, in this tree by showing step by step comparison. 4

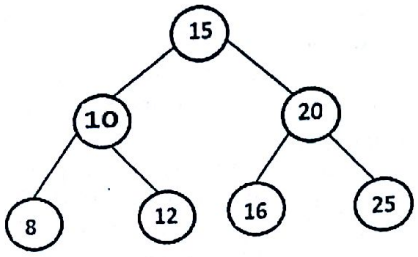


Fig-1: A binary tree T

b) Build a *Heap* tree, step by step, for the following items: 6
44, 30, 15, 45, 70, 55, 75, 80

7. a) Find out the shortest path matrix using the modified Warshall's algorithm for the following graph (***Fig-2***). Here v1=A, v2=B and v3=C. 4

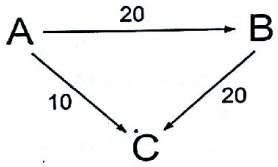


Fig-2: A directed-weighted graph

b) Draw a schematic diagram of a linked representation of graph G (Fig- 3) in memory. 4

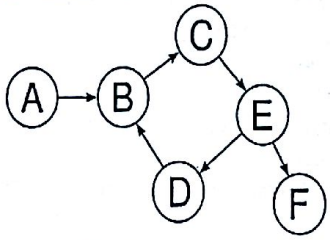


Fig-3: Graph G

c) **The pre-order and in-order traversal sequences of nodes in a binary tree are given below :** 2
Pre-order — M A D H U S M I T A
In-order — M A D H U S M I T A
Construct the binary tree and state the logic to construct the tree.

8. a) What is connected graph? 1
b) Explain merge sort using an example. 3
c) Consider the following list of 11 numbers: 33 11 77 45 23 17 6 0 25 71 31 85 3
Use the Quick sort algorithm to find the final position of 33.
d) Suppose 9 cards are punched as follows: 348, 143, 361, 423, 538, 128, 321, 543, 366. 3
Sort the numbers using Radix sort.

Bangabandhu Sheikh Mujibur Rahman Science & Technology University, Gopalganj
Department of Computer Science & Engineering
1st year 2nd semester B.Sc. Engineering Examination-2016
Course No. : PHY 154, Course Title: Physics

Full Marks: 60 **Time:** 3hours

N.B. i) Answer **SIX** questions taking any **THREE** from each section.
ii) All questions are of equal values.
iii) Use separate answer script for each section.

Section-A

Q.1. a) State Newton's second law of motion and obtain the unit of the force. 4
b) What is projectile? Find out the condition for maximum horizontal range of a projectile. 3
c) A body of mass 5 kg at rest explodes into three pieces. Two pieces, each of mass 1 kg fly off perpendicular to each other with a speed of 100 m/s. Calculate the velocity of the third piece. Also calculate the ratio of the kinetic energy of third piece and one of the small pieces. 3

Q.2. a) Derive an expression for the centripetal acceleration of a body moving with a uniform velocity in a circle. 4
b) Evaluate the law of gravitation using Kepler's law of motion. 4
c) Calculate the mass of the earth from the following data: g = 9.80 m/s^2, G = 6.67× 10^{-11} M. K. S units, R = 6.38× 10^6 m. 2

Q.3. a) Define simple harmonic motion. Show that for a particle executing simple harmonic motion, it's velocity at any instant is $\frac{dy}{dt} = \Omega\sqrt{a^2 - y^2}$. 3
b) Derive the differential equation of damped oscillatory motion and give its general solution. 5
c) In an oscillatory circuit, L = 0.2 henry, C = 0.0012 μF. What is the maximum value of resistance for the circuit to be oscillatory? 2

Q.4. a) Deduce the expression for the adiabatic process pv^γ = a constant; where p is the pressure of the gas, V is the volume of the enclosure and γ is the ratio of the molar specific heat. 5
b) What do you meant by γ? Initially, 1mol of oxygen (assumed to be an ideal gas) has temperature 310 K and volume 12L. We will allow it to expand to volume 19 L. What would be the final temperature if the gas expands adiabatically? 5

Section-B

Q.5. a) State the principle of superposition of waves. Explain the working principle of Young's double slit experiment. 5
b) State Plank's radiation law. Give the Plank's quantum postulates. 3
c) Two coherent sources are 0.18 mm apart and the fringes are observed on a screen 80 cm away. It is found that with a certain monochromatic source of light, the fourth bright fringes is situated at a distance of 10.8 mm from the central fringe. Calculate the wavelength of light 2

Q.6. a) Distinguish between Fraunhoffer and Fresnel diffraction. 3
b) What do you understand by the term polarization of light? 2
b) Give your concept on polarimetry with proper example. 3
d) In the Fraunhoffer diffraction pattern due to a narrow slit a screen is placed 2cm away from the lens to obtain the pattern. If the slit width is 0.2 mm and the first minima lie 5mm on either sides of the central maximum, find the wavelength of light. 2

Q.7 a) State and explain Coulomb's law in electrostatics. 5
b) Write the basic difference between DC and AC current. 3
c) Find the force between two parallel wires, 100cm long, 2 cm apart, and carrying a current of 20 amp. 2

Q.8 a) What do you meant by pointing vector? 2
b) Deduce the expression of $v = \frac{c}{\sqrt{\mu_r \varepsilon_r}}$; with the help of Maxwell's equations. 4
c) Deduce the Ampere's law from Maxwell's equations. 4

Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science and Engineering
B.Sc. Engineering 1st Year 2nd Semester, Final Examination-2016
Course No: MAT156 Course Title: Differential and Integral Calculus

Full Marks: 60 Full Time: 3 hours

N. B. (i) The figures in the right margin indicated full marks. (ii) Answer **six** questions, taking any **three** from each group.

Group-A

1. (a) Define differentiability and continuity of a function at a point. 2

(b) Show that every differentiable function is continuous, but conversely is not always true. 4

(c) Define continuity of a function. Examine the limit of the function $f(x)=|x+1|+|x|+|x-1|$ at $x=0$ *and* $x=1$. Does continuity exists at $x=1$? 4

2. (a) State and proof L'Hospital rule. 4

(b) If $y=\sin px+\cos px$ then show that $y_r = p^r\left[1+(-1)^r \sin 2px\right]^{1/2}$ 3

(c) Find the differential coefficient of $\tan^{-1}\dfrac{2x}{1-x^2}$ with respect to $\sin^{-1}\dfrac{2x}{1+x^2}$ 3

3. (a) State and proof Leibnitz's theorem. 4

(b) If $y=\sin\left(m\sin^{-1}x\right)$ then prove that $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}+(m^2-n^2)y_n=0$ 3

(c) Find the maximum or minimum value of the function $f(x)=x^5-5x^4+5x^3-1$ 3

4. (a) State the Rolle's theorem. Verify the Rolle's theorem for the function $f(x)=1-(x-1)^{2/3}$ in the interval [0,2]. 4

(b) Verify the Mean value theorem for the function $f(x)=x(x-1)(x-2)$ in the interval $[0, 1/2]$. 3

(c) State Euler's theorem. Using Euler's theorem prove that $x\dfrac{\delta u}{\delta x}+y\dfrac{\delta u}{\delta y}=\sin 2u$, where 3

$u(x,y)=\tan^{-1}\dfrac{x^3+y^3}{x-y}$.

Group-B

5. Evaluate (Any three) 3.3×3= 10

(i) $\int \dfrac{dx}{\sqrt{2x^2+3x+4}}$ (ii) $\int \sin^{-1}\sqrt{\dfrac{x}{x+a}}dx$ (iii) $\int \dfrac{dx}{5+4\sin x}$

(iv) $\int \dfrac{dx}{(x-3)\sqrt{x+1}}$ (v) $\int \dfrac{dx}{a+b\sin x}$

6. (a) State and prove the Fundamental Theorem of Integral Calculus. 5

(b) Prove that $\int_{-\pi}^{\pi} f(x)dx = \begin{cases} 2\int_0^{\pi} f(x)dx & ; \text{when } f(x) \text{is even} \\ 0 & ; \text{when } f(x) \text{is odd} \end{cases}$ 5

7. Evaluate (any three) 3.3×3= 10

(a) $\int_0^{\pi/2} \ln(\cos x)\,dx$ (b) $\int_0^{\pi/2} \dfrac{dx}{3+2\sin x}$ (c) $\int_0^{\pi} \dfrac{x\sin x}{1+\cos^2 x}dx$ (d) $\int_0^{\pi/2} \dfrac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}dx$

8. (a) State the Wallis's formula .If $I_n = \int_0^{\frac{1}{4}\pi} \tan^n\theta\,d\theta$, show that $I_n = \dfrac{1}{n-1} - I_{n-2}$. Hence find the value of $\int_0^{\frac{1}{4}\pi} \tan^6\theta\,d\theta$. 6

(b) Find the area of the region bounded by the asteroid $x^{2/3}+y^{2/3}=a^{2/3}$ 4