KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year Second Term Examination, 2018
Department of Computer Science and Engineering
CSE 2201
Algorithm Analysis and Design

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What do you mean by Algorithm? What are the basic criteria that an algorithm must satisfy? (09)
b) Consider the code segment of addition of two matrices mentioned in the following figure. (10)

```
int **matrix_sum(int m1[][3],int m2[][3]){
  int i, j, **m3;
  m3 = malloc(sizeof(int*)*3);
  for(i=0;i<3;i++)
  {
    for(j=0; j<3; j++)
    m3[i][j]=m1[i][j]+m2[i][j];
  } return m3;}
```

Let int takes 2 bytes in memory. Now, show the step counts of the above program with respect to space and time, where the unit of space and time, where the unit of time is m sec.

c) Write down the best Big-oh (o) characterization for each of the running time estimates of different algorithms: (i) log(n!), (ii) 6.2^n+n^2 (iii) $1000n^2+100n-6$ (iv) $6n^3/(\log n+1)$. (16)

2. a) The complexity of a merge sort algorithm can be described as follows: (15)

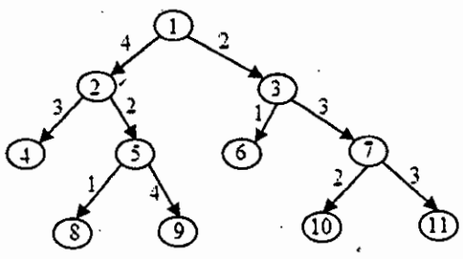
$$\begin{cases} a & ,n=1 \\ 2T\left(\frac{n}{2}\right)+cn, & n>1 \end{cases}$$

Here a, c are two constants. Derive an appropriate best case notation for the above recurrence relation.

b) Differentiate between the followings: (i)Brach and bound vs Backtracking (ii) Brute-force vs Backtracking (08)

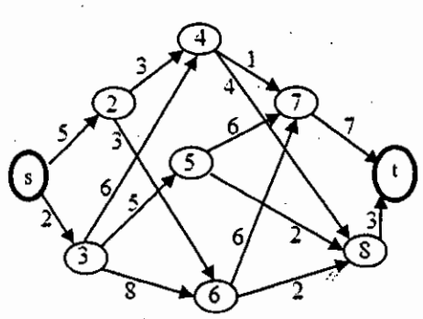
c) What is constrain? How the constraints are useful in Backtracking method? Show the constraints of N-Queen Problem and applying these constraints write a recursive backtracking algorithm to solve N- Queen problem. (12)

3. a) Consider the graph mentioned in following figure (13)
Now split the vertex of the graph using greedy method.



b) Write down the control abstraction of greedy method. (07)

c) What is principle of optimality in Dynamic programming? Consider the graph mentioned in the following figure: (15)
Using forward approach find a minimum-cost path from s to t in the above multistage graph.



4. a) What do you mean by approximation algorithm? Why do we need approximation algorithm? (09)
b) Define NP-hard and NP-complete problems? Prove that clique problem is NP-complete. (06)
c) Why do we need process mapping in parallel algorithm? Map processes using intermediate data decomposition for the following operation: (12)

$$\left[\begin{pmatrix} A_{1,1} & A_{1,2} \\ A_{2,1} & A_{2,2} \end{pmatrix} \times \begin{pmatrix} B_{1,1} & B_{1,2} \\ B_{2,1} & B_{2,2} \end{pmatrix} + \begin{pmatrix} C_{1,1} & C_{1,2} \\ C_{2,1} & C_{2,2} \end{pmatrix}\right]^T = \begin{pmatrix} D_{1,1} & D_{1,2} \\ D_{2,1} & D_{2,2} \end{pmatrix}$$

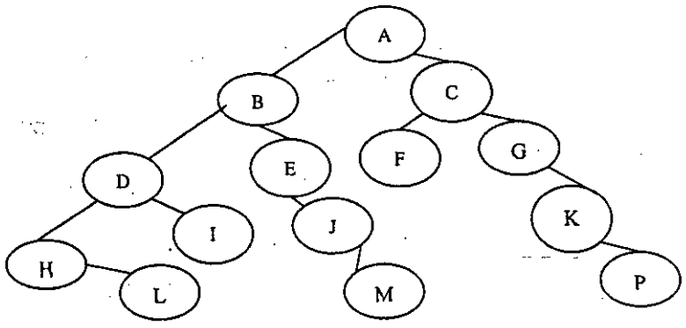
d) "Is the minimum spanning tree generated using Krushkal's and Prims unique? Explain your answer with example." (08)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

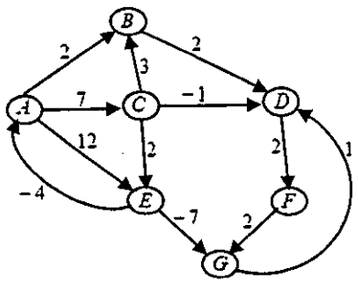
5. a) Graphs can be represented using adjacency Lists or adjacency matrices. What are the memory requirements of each representation? Discuss some advantages and disadvantages for each representation. (10)

b) In the following graphs, starting from the node A at the top, which algorithm will visit the least number of nodes before visiting the node F. Breadth First Search or Depth First Search? Briefly explain the process to visit F node from node A. (13)



c) In scheduling independent tasks problem let the number of processor, $m = 3$ number of tasks $n = 7$, where $(t_1, t_2, t_3, t_4, t_5, t_6, t_7) = (5, 2, 2, 4, 3, 5, 3)$. Schedule the tasks by Longest processing Time (LPT) rule and then find the time difference between LPT scheduling and optimal scheduling. (12)

6. a) Consider the following directed, weighted graph. (20)

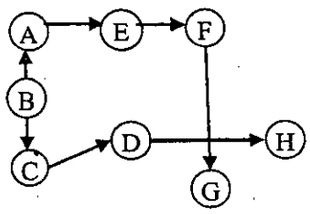


i) Even though the graph has negative weight edges, step through Dijkstra's algorithm to calculate shortest paths from A to every other vertex

ii) Dijkstra's algorithm found the wrong path to some of the vertices. For just the vertices where the wrong path was computed, indicate both the path that was computed and the correct path.

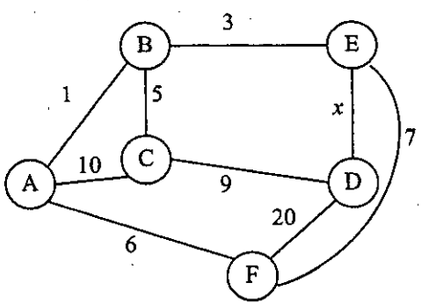
iii) What single edge could be removed from the graph such that Dijkstra's algorithm would happen to compute correct answers for all vertices in the remaining graph.

b) Apply Topological sort in Lexicographical order of the following graph. If the graph has multiple answer then mention all of them. (10)

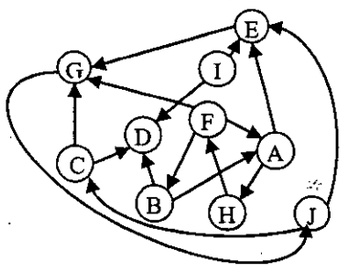


c) Describe in steps how the Ford-Fulkerson algorithm finds the maximum flow. (05)

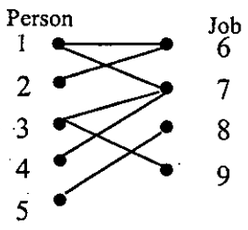
7. a) For the following graph the bold edges form a minimum spanning tree what can you tell about the range of values for X? If $x = 5$, then use prim's algorithm starting at node A to compute the MST of the following graph. In particular write down the edges of the MST in the order in which prim's algorithm adds them to the MST. Use the format (node1, node2) to denote on edge. (12)



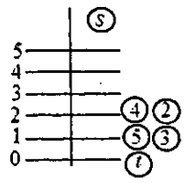
b) What are the strongly connected components of the graph below? (13)



Define bipartite graph. Find the maximum matching using khokho idea of the following bipartite graph. (10)

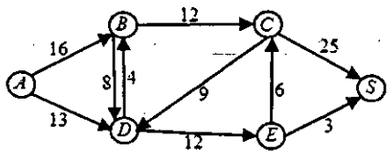


8. a) Consider the following max flow problem given by the push relable algorithm. The distance labels are given at left the numbers above or below the nodes are accesses The numbers on the arcs are the residual capacities. (18)



i) Is the labeling of the nodes valid? (ii) What are the admissible arcs? (iii)Which nodes are active? (iv)A potential method was used to prove the $O(V^2E)$ time bound-what was the potential method? Apply the potential method to calculate the max flow of the following network.

b) Write down the differences between Ford – Fulkerson and Edmonds- Karp algorithm. Apply ford-Fulkerson algorithm for the network in following figure. (17)



KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year 2nd Term Examination, 2018
Department of Computer Science and Engineering
CSE 2203
Microprocessors and Microcontrollers

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Define microprocessor. Briefly explain the building blocks of a microprocessor with proper diagram(s). (09)
   b) How 8086 and 8087 execute their respective instructions? (06)
   c) What are the functions of PSW register in 8051μc? Also explain the function of the following pins of 8051μc: (10)
   $\overline{PSEN}$, *ALE* and $\overline{EA}$.
   d) Describe the DMA transfer timing diagram with appropriate figure(s). Explain the function of the following registers: (10)
   CAR, *MR* and *SR*.

2. a) Construct the binary code for each of the following 8086 instructions. (12)
   (i) MOV CS:[BX], DL (ii) IN AL,DX (iii) ADD BX, 59H[DI]
   b) Explain program development algorithm with a proper flowchart. (08)
   c) If the 8086 data segment register contains 7000H, write the instruction that will copy the contents of DL to address 74B2CH. (05)
   d) Detect and correct syntax errors in the following instructions if there is any. (05)
   (i) MOV BX, [3502H] (ii) MOV DX,CL
   e) Convert 8.67 to single-precision floating point. (05)

3. a) "8259A acts as a funnel"-justify the statement. (05)
   b) Explain the cascading of 8259A with 8086 with a proper diagram. (12)
   c) Write the instructions in order to set and reset the trap flag. Explain in brief how these instructions perform the desired function. (08)
   d) Why is the INTR input automatically disabled as a part of the response to an INTR interrupt? Justify your answer. (05)
   e) The starting address for a type 4 interrupt-service procedure is 0010:0082. Show where and in what order this address should be placed in the interrupt vector table. (05)

4. a) Explain instruction set architecture (ISA). (05)
   b) Describe dual pipelining and superscalar architecture to achieve instruction level parallelism. (12)
   c) Suppose, AM2901, an architecture logic unit which forms a 4-bit slice of an arithmetic logic unit of a bit slice microprocessor. How AM2901s can be assembled to create a 12-bit ALU? Illustrate with proper diagram. (08)
   d) Write down the difference between CISC and RISC. (05)
   e) Consider, a program with 80% of executed instructions being simple and 20% complex. (05)
   CISC: simple instructions take 4 cycle, complex instructions take 8 cycle, and cycle time is 100 ns.
   RISC: simple instructions are executed in one cycle, complex operations are implemented as a sequence of instructions (14 instructions on average), cycle time 75 ns.
   Measure the amount of time in seconds that a program of 1000,000 instructions will take if we execute it in CISC and RISC architecture separately.

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Which feature of microprocessor determine the size of it? (07)
   b) Describe the function of 8086 queue. How does the queue speed up processing? (11)
   c) Write down the functions of condition and control flags of 8086 μp. (09)
   d) Mention the trade-off of choosing between assembly language and high level language. (08)

6. a) What is Bit-slice microprocessor? (06)
   b) Write the instruction in order to set or reset the trap flag. Explain in brief how these instructions perform the desired function. (09)
   c) What are the limitations of using registers to pass parameters? How can it be overcome? (08)
   d) What is the difference between near call and far call? (07)
   e) What is the advantage of using assembly language instead of writing a program directly in machine language? Explain in brief. (05)

7. a) Illustrate the internal block diagram of 8254 programmable interval timer. (10)
   b) Explain the following operational modes of 8254 interval timer. (10)
      (i) Hardware retrigger able one-shot.
      (ii) Hardware triggered strobe.
   c) Describe how the protected mode of operation of an 80286 is different from real mode of operation. (10)
   d) Write down the limitation of 80286. (05)

8. a) Write down the salient features of 8051 microcontroller. (05)
   b) Explain "Register Banks" with a proper diagram. (05)
   c) Write the down the function of virtual mode flag and resume flag in 80386. (05)
   d) How 16,384 segment X 65,536 bytes/segment or about 1 Gbyte of logical of virtual address space can be achieved? Explain with necessary figures(s). (10)
   e) Explain the basic features of 80186 microprocessor. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year 2nd Term Examination, 2018
Department of Computer Science and Engineering
CSE 2207
Numerical Methods

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Find the absolute and relative errors in evaluating the following expressions: (10)
(i) $\sqrt{x^2+y^2}$ (ii) xe^y
Where true value and measured value of x, y are 1.25, 2.16, and 2.25, 3.89 respectively.
b) What is Inherent Errors? Classify it with Examples. (06)
c) What are the differences between bracketing and open end methods? (07)
d) Find the round-off errors, Accuracy and Precision in the result of the following arithmetic operations, using four digit mantissa. (12)
(*i*) $25.68 \div 6.567$ (*ii*) $87.26 + 31.42$ (*iii*) $752.6835 \div 2.913$

2. a) How can you find the largest possible root and can search bracket of a polynomial? (05)
b) Use the secant Method to compute a root of the following equation: $x^2 - 5x + 6 = 0$ where $x_1 = 4$, $x_2 = 5$ and stopping criteria $|x_{i+1} - x_i| \le 0.002$ (12)
c) Show through an example that the number of correct digits approximately doubles with each iteration in Newton- Rapson Method. (10)
d) Find the root of the equation using Newton-Raphson Method: (08)
$x^2 - 3x + 2 = 0$; initial estimate, $x_0 = 0$

3. a) What is Interpolation? Give practical examples. (04)
b) From the concept of Interpolation with Equidistant Point show that $P_n(S) = \sum_{j=0}^{n} \binom{s}{j} \Delta^j f_0$ (13)
where $\binom{s}{j} = \frac{s(s-1).....(s-j+1)}{j!}$
c) Find the Langrange Interpolation Polynomial to fit the following data: (12)

x	1	2	3	4	5
$f(x)$	1	1.4142	1.7321	2	2.2361

Use it to estimate square root of 2.5.
d) Derive Linear Interpolation Formula. (06)

4. a) What is Regression Analysis? Fit a straight line to the following set of data: (15)

x	1	2	3	4	5	6
y	2	4	5	7	9	13

b) Derive a fourth – order Divided Difference Table. (05)
c) Estimate the value of ln(3.5) using Newton-Gregory backward difference formula. Given the following data. (15)
$\ln(1.0) = 0.0$ $\ln(2.0) = 0.6931$
$\ln(3.0) = 1.0986$ $\ln(4.0) = 1.3863$

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) What is liebmann's iteration method? What are its advantages? (10)
   b) Derive a difference equation to represent a poison's equation. (13)
   c) Solve the poisons equation $\Delta^2 f = 2x^2y^2$ over the squire domain $0 \le x \le 3$ and $0 \le y \le 3$ with $f = 0$ on boundary and $h = 1$. (12)

6. a) Define dependent and independent variable. (08)
   b) Derive the equation for the Modified Euler's method. (16)
   c) Given $\frac{dy}{dx} = \frac{y-x}{y+x}$, with $y = 1$ for $x = 0$. Find y approximately for $x = 0.1$ by Euler's method. (11)

7. a) Write the differences between (i) homogeneous system of equations and (ii) non homogeneous system of equations. (10)
   b) What can be done by R-K (Runge-Kutta) method? Explain it with an example. (12)
   c) Solve $\frac{dy}{dx} = \frac{1}{x+y}$ for $x = 0.5$ to $x = 2$ assume $h = 0.5$ by using Runge-Kutta's method, with $x_0 = 0,\ y_0 = 1$. (13)

8. a) Solve the following equation by Jacobi Iterative method. (12)

$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72$$
$$x + y + 54z = 110$$

   b) Solve the following equations by factorization method. (13)

$$2x + 3y + z = 9$$
$$x + 2y + 3z = 6$$
$$3x + y + 2z = 8$$

   c) Describe the basic principle of the Bisection Method. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year 2nd Term Examination, 2018
Department of Computer Science and Engineering
HUM 2207
Economics and Accounting

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) How economics is like a 'science'? Explain the idea of Economics, Microeconomics and Macroeconomics. (15)
   b) Explain the basic problems of an Economic systems. How does the basic problems be solved? (20)

2. a) Pharmaceutical drugs have an inelastic demand and computer have an elastic demand. Suppose that technological advance doubles the supply of both products. What happens to the equilibrium price and quantity in each markets? Which product experiences a larger change in price, which in quantity? Explain. (15)
   b) What is indifference curve? Discuss the characteristics of indifference curve? (20)

3. a) Draw and explain the marginal cost and average cost curves for a typical firm. Explain why the curves have the shapes that they do and why cross where they do? (15)
   b) "High prices traditionally cause expansion in an industry, eventually bringing an end to high prices as manufacturer's prosperity" Explain, using appropriate diagrams. (20)

4. a) What is GDP? Why do Economist use real GDP rather than nominal GDP to gauge economic wellbeing? (15)
   b) What is National savings, private savings, and public savings? Describe a tax-code that might increase private savings and investment. If this policy was implemented, how would it affect the market for loanable funds? (20)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Define accounting. State the importance of accounting. (15)
   b) Who are the users of accounting information? (05)
   c) Distinguish between book-keeping and accounting. (05)
   d) Briefly describe the steps of accounting cycle. (10)

6. a) What is trial balance? What are the errors that can't be detected by trial balance? (15)
   b) What is the main purpose of preparing a trial balance? (05)
   c) The following accounts are taken from the ledger of Neha company at December 31,2017 (15)

Name of accounts	Tk
Cash at bank	43,400
Sales return	2,800
Sales	48,500
Depreciation	700
Allowance for bad debit	31,000
Accumulated depreciation	19,500
Advance paid salaries	31,100
Interest received	67,000
Rent Receivable	27,550
Motor car	41,500
Profit on sale of furniture	11,250
Bills Payable	20,250
Income tax expense	26,700
Loss on fire	2,650
Goodwill	21,100

Prepare a trial balance.

7. a) What is conceptual framework of accounting? Discuss the required qualities of accounting information. (15)
   b) Explain double entry system of accounting. (10)
   c) Define cost. Classify cost in relation to the product. (10)

8. The following balances are taken from the books of accounts of Sanju Ltd on 30th June, 2004 (35)

Sanju Ltd.

Trial balance as on 30.06.2004

Particulars	Debit	Credti
Account Receivable	29,000	
Purchases	81,000	
Allowance for doubtful accounts		16,000
Inventories	6,000	
Furniture	10,000	
Accumulated depreciation-Furniture		4,000
Buildings	1,40,000	
Accumulated depreciation Building		30,000
Cash	2,000	
Bad debts	6,000	
Salaries	20,000	
Interest expense	4,000	
Rent, rates, taxes	6,000	
Salesman's salaries	2,000	
Freight in	7,000	
Dividend	15,000	
Sales		2,00,000
Interest Income		1,000
Bonds Payable		10,000
Capital		60,000
Retained earnings (30.606.2003)		7,000
Total	3,28,000	3,28,000

Adjustment are to be made as follows:-

(i) Inventory on hand is tk. 10,000
(ii) Depreciation on furniture is to be 10% a year.
(iii) Buildings are depreciated at 5% per year.
(iv) The allowance for doubtful account is to be increased to a balance of tk. 19,000.
(v) Accrued salaries tk 2,000.
(vi) Accrued interest on bonds tk 1,000
(vii) Accrued selling expense tk. 1,500
(viii) Income taxes are estimated to be 50% of the income before income taxes.

Required :

(a) Prepare a statement of comprehensive income.
(b) Prepare a statement of Financial Position.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year 2nd Term Examination, 2018
Department of Computer Science and Engineering
MATH 2207
Complex Variables Vector Analysis and Statistics

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Table, Graph ($X^2-table, t-table, z-table$) will be supplied in the exam hall.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) The frequency distribution are given below: (17)

Class interval	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	10	15	20	5	6	4

Calculate the first four raw moment about 85 from the above table. Also find skewness, kurtosis and comment on the result.

b) Define random experiment and random variable with example. (06)

c) Find the first four moments of the following probability density function. Also draw the function; Where $f(x)=\begin{cases}\frac{1}{4} & if\ 1\le x\le 5\\ 0 & otherwise\end{cases}$ (12)

2. a) Test whether the following functions are probability mass function or not. If exist then find mean and $p(x>0)$ for each function: (13)

(i)

x	-1	0	1	2
p(x)	3k	-2k	0.4	0.6

(ii)

x	-2	0	2	4	6	8
p(x)	2k	2k	k	0.5	0.3	0.2

b) Define normal distribution. Hence derive its mean or mode. (12)

c) Define uniform distribution. Show that function defined by you (for uniform distribution) be a probability density function. (10)

3. a) What are the necessary assumption you need regarding Binomial distribution? Write down four properties of poison distribution and Normal distribution. (08)

b) The network traffics are observed at KUET web-server. Assume the following observations are made by the webmaster measured at 30 second intervals. (10)

values attack	0	1	2	3	4	5
observation	5	10	5	4	2	1

Let the rate 8 virus per min is the level of critical traffic load (i) Find the probability of virus attack- below of the traffic load. (ii) Find the probability of virus attack-exactly reach at the level of critical load.

c) Fit the following data into Normal distribution. Hence test its goodness with 5% level of significance. It is noted that the mean and standard deviation of the student's scores are 13 and 4 respectively. (17)

score	0-5	6-10	10-15	16-20
No of student	3	8	13	6

4. a) Suppose there are 11000 individuals in any job recruiting test. Let the average score is 40(in percentage) and variance is 49. Also assume that scores are normally distributed. Find the expected number of candidates who are (12)
   (i) not qualified (ie score < 25)
   (ii) qualified but not eligible for choosing all departments (25 < score <60)
   (iii) qualified and eligible for choosing any departments (score > 60)
   It is noted that the required probabilities should be shown in figures.

b) Write a short note on scaling of vectors using matrix operation. (08)

c) If $\phi(x,y,z)$ is a scalar invariant with respect to a rotation of axes, prove that grad ϕ is a vector invariant under this transformation. (09)

d) Define vector quantity, vector point function and vector field with example. (06)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Define whether $\lim_{z\to 0} t^{z/\bar{z}}$ exist or not. (07)

   b) Examine the differentiability and continuity of $f(z)=|z|^2$ at origin. (10)

   c) Prove that the function $f(z)=\dfrac{xy^2(x+iy)}{x^2+y^4}$, $z\neq 0$; 0, $z=0$ is not analytic at origin although C.R. equations are satisfied there. (18)

6. a) Define with an example: (i) Singular point, (ii) Pole (iii) Branch point and (iv) Removable singular point. (12)

   b) Find the singular points of the following functions and determine their nature: (12)

   $(i) f(z)=\dfrac{e^{-z}}{(z-2)^4}$ $\quad$ $(i) f(z)=\sin\dfrac{1}{z-1}$

   c) Using Cauchy's integral formula evaluate $\oint_c \dfrac{zdz}{(9-z^2)(z+i)}$, where C is the circle $|z|=2$. (11)

7. a) Using appropriate theorem evaluate (13)

   $\iint_s \bar{F}.nds$ where s is the surface bounded by the planes: $x=0, y=0, z=0, x=2, y=2, z=2$

   and $\bar{F}=x^2\hat{i}+y^2\hat{j}+z^2\hat{k}$.

   b) If $\underline{F}=3xy\underline{i}-y^2\underline{j}$, evaluate $\int_C \underline{F}.d\underline{r}$ where C is the curve in the xy plane, $y=2x^2$, from (0,0) to (1,2). (12)

   c) Evaluate grad div $\left(\dfrac{\bar{r}}{r}\right)$. (10)

8. a) Test whether the vector field $\bar{F}$ is rotational or not. If possible find the scalar potential such that scalar solution be zero at (0,0,0) . Given $\bar{F}=\dfrac{\bar{r}}{r^2}$. (15)

   b) Evaluate $\iint_s \underline{A}.\underline{n}ds$ where $\underline{A}=(x+y^2)\underline{i}-2x\underline{j}+2yz\underline{k}$ and S is the surface of the plane $2x+y+2z=6$ in the first octant. (10)

   c) Evaluate $\oint_c (xy+y^2)dx+x^2dy$ by using Green's theorem, where C is the closed curve of the region bounded by $y=x$ and $y=x^2$. (10)