

THE DEPARTMENT OF ADVANCED SCIENCE AND TECHNOLOGY
UNIVERSITIES OF COMPUTER STUDIES
FIRST SEMESTER EXAMINATION
FOURTH YEAR (B.C.Sc. /B.C.Tech.)
MARCH 2015 (ZONE IV)

Answer all questions.

ENGLISH

Time allowed: 3 hours

QUESTION-1(20 marks)

In a study titled Male and Female Drivers: How different are they? Professor Frank McKenna of the University of Reading looked at the accident risk between men and women. He found that men drive faster, commit more driving violations, and are more inclined to drink and drive. They look for thrills behind the wheel, while women seek independence. And, although anecdotal evidence might suggest otherwise, women are not starting to drive as aggressively as men.

The question of whether, as drivers, women differ from men is important, because it could affect insurance premiums, which are closely geared to accident statistics.

Despite the increase in women drivers, McKenna's researchers found no evidence that this is changing accident patterns. It seems that age is far more important than gender in the car. It is the biggest single factor in accident patterns, and, while inexperienced new drivers of both sexes are more likely to be involved in accidents, the study found striking new evidence to confirm that young men drive less safely than any other group.

The survey shows that men and women aged 17 to 20 are most likely to be involved in bend accidents – men almost twice as often – but the difference decreases as drivers mature.

Nearly half of all accidents involving young men and one-third of those involving young women take place when it is dark. Again, there is a steady decrease in such accidents as drivers grow older, but gender differences remain significant until drivers reach the age of 55.

Although there is little difference between men and women in the distance they keep from the car in front, there are differences across age groups. Young drivers show less regard for the danger of following more closely, and young men are likely to 'close the gap' as an aggressive signal to the driver in front to speed up or get out of the way.

Men consistently choose higher speeds than women of the same age and driving experience. "This could be because men seek a thrill when they drive," says McKenna. "Speed choice is one of the most important causes of accidents. But breaking the speed limits is regarded by men as a minor offence."

Contrary to public belief, young drivers, as a group, are more likely to avoid drinking alcohol if they are driving, while men in the 30 to 50 age group admitted to drinking the most alcohol before driving. Men are most likely to nod off, probably because they are willing to drive for longer periods without a break – driver fatigue is a significant factor in accidents.

According to Andrew Howard, of the Automobile Association, "We have to combat the group that speeds for thrills. The key is how men are brought up to look at the car. It is this which needs to be addressed."

Questions 1-5

Classify the following statements (1 – 5) as applying to

- | |
|----------------------------------|
| A men in general |
| B young men in particular |
| C both young men and young women |

Example

They are the most likely to have accidents while driving B

1. They may follow another car closely to make the driver go faster.
2. They are more likely to have accidents due to tiredness.
3. They are the least likely to drink and drive.
4. Driving gives them a feeling of excitement.
5. They are the most likely to have accidents on bends.

Questions 6 – 10

Do the following statements agree with the information in the text?

Write

TRUE if the statement agrees with the information given

FALSE if the statement disagrees with the information given

DOES NOT SAY if there is no information about it

6. There is a common belief that women are becoming more aggressive drivers.
7. The results of the study may influence the cost of motor insurance.
8. Young women are most likely to have accidents when driving at night.
9. Men do not consider it very serious to exceed the speed limit.
10. Women are more prone to accidents at junctions than men.

QUESTION-II(A) (10marks)

Complete the summary using the list of words below.

Ants have sophisticated methods of farming, including herding 1..... and growing crops, which are in many ways similar to those used in human 2..... . The ants cultivate a large number of different 3..... of edible fungi which convert cellulose into a form which they can digest. They use their own natural 4..... as weed-killers and also use unwanted 5..... as fertilizers. Genetic 6..... show they constantly upgrade these fungi by developing new species and by exchanging species with neighbouring ant 7..... . In fact, the farming methods of ants could be said to be more advanced than human 8....., since they use sustainable 9....., they do not affect the environment and do not waste 10..... .

species	energy	livestock	methods
materials	analysis	agriculture	secretions
colonies		agribusiness	

QUESTION- II (B) (10marks)

Describe an idea you had for improving something at work or college.

You should say:

- when and where you had your idea
 - what your idea was
 - who you told about your idea
- Explain why you thought your idea would make an improvement.

QUESTION-III(10marks)

Choose the correct form of the verbs. Just write down the number and the answer.

1. Mario remembered to give/giving his assignment to his tutor because he had spoken to her about its length, but she insisted that she had never received it.
2. If you can't find the information at the library, try to look/looking on the internet.
3. She studied medicine at university and went on to become/ becoming a surgeon.
4. Look at Mum's car! It definitely needs to clean/cleaning.
5. I'll never forget to fall/falling off that swing when I was a child.
6. I was really nervous about the interview, and although I tried not to worry/not worrying, I was awake most of the night.
7. The new government needs to take/taking notice of the opinions of the people.
8. It seems that the new system of sending out reminders has worked, because this year 90% of members remembered to renew/renewing their membership in time.
9. Economists predict that house prices will go on to rise/rising for at least another year.
10. We weren't able to see the concert because Tamsin forgot to bring/bringing the tickets.

QUESTION-IV (10 marks)

Put the verb into the correct form.

1. It was a terrible film. I wish..... to see it.(we/not/go)
2. What I said was stupid. I wish anything .(I/not/say)
3. I should have listened to you. I wish your advice. (I/take)
4. What's her name again? I wish remember her name.(I/can)
5. The weather was cold while we were away. I wish warmer.(It/ be)
6. I wish here. She'd be able to help us.(Ann/be)
7. It's a difficult question. I wish the answer. (I/ know)
8. It's freezing today. I wish so cold. I hate cold weather.(it/ not/be)
9. I feel sick. I wish so much cake. (I/not/eat)
10. It would be nice to stay here. I wish to go now.(we/not/have)

QUESTION-V (20marks)

Report each of these sentences. Remember that you do not need to report the original words exactly.

1. 'We are very sorry that we lost your application form.'
They apologised.....
2. 'Why aren't there many poisonous snakes in Britain?'
He asked
3. 'Are you going to the lecture tomorrow?'
She asked
4. 'Why don't you have a day off? You could do with a rest.'
She suggested.....
5. 'Please come to the theatre with me, Dan. I really think you'll enjoy it.' 'Oh, alright then, Claire.'
Claire persuaded.....

6. 'We are going to lower taxes and reduce unemployment!'
The government promised.....
7. 'I really think you should apply for the job. You'd have a good chance of getting it.'
She encouraged.....
8. 'No, I won't help you. Do it yourself!'
He refused.....
9. 'Oh, okay, I'll go to the meeting.'
She agreed
10. 'I didn't cause the accident. It wasn't me.'
He denied.....

Answer A

Linear Pro

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QUESTION-VI(20MARKS)

Do you agree or disagree with the following statement?

'Modern technology enables people to travel further and faster, for less money. This can only be a good thing.'

To what extent do you agree with this statement?

(b)Use S

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and

(c)Use pe

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s.t

and

Queueing

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(b)Patien

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Department of Advanced Science and Technology

University of Computer Studies

B.C.Sc. (Fourth Year)

Mid Term Examination

Operations Research (CS-401)

March, 2015

Answer All Questions

Zone IV

Time allowed: 3 hours.

Linear Programming

1(a) A company has two plants each of which produces and supplies two products: A and B. The plants can each work upto 16 hours a day. In plant 1, it takes three hours to prepare and pack 1000 gallons of A and 1 hour to prepare and pack one quintal of B. In plant 2, it takes two hours to prepare and pack 1000 gallons of A and 1.5 hour to prepare and pack a quintal of B. In plant 1, it costs Rs 15,000 to prepare and pack 1000 gallons of A and Rs 28,000 to prepare and pack a quintal of B whereas these costs are Rs 18,000 and Rs 26,000 respectively in plant 2. The company is obliged to produce daily at least 10 thousand gallons of A and 8 quintals of B. Formulate this problem as an LP model to find out as to how the company should organize its production so that the required amounts of the two products be obtained at minimum cost.

(b) Use Simplex method to solve the LP problem.

$$\text{Maximize } Z = 5x_1 + 3x_2$$

s.t

$$x_1 + x_2 \leq 2$$

$$5x_1 + 2x_2 \leq 10$$

$$3x_1 + 8x_2 \leq 12$$

and

$$x_1, x_2 \geq 0$$

(c) Use penalty (Big-M) method to solve the LP problem.

$$\text{Maximize } Z = x_1 + x_2 + x_4$$

s.t

$$x_1 + x_2 + x_3 + x_4 = 4$$

$$x_1 + 2x_2 + x_3 + x_4 = 4$$

$$x_1 + 2x_2 + x_3 = 4$$

and

$$x_1, x_2, x_3 \geq 0$$

Queueing

2(a) Arrivals at a telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of phone call is assumed to be distributed exponentially, with mean 3 minutes. (i) What is the probability that a person arriving at the booth will have to wait? (ii) The telephone department will install a second booth when convinced that an arrival would expect waiting for at least 3 minutes for a phone call. By how much should the flow of arrivals increase in order to justify a second booth? (iii) What is the average length of the queue that form from time to time? (iv) What is the probability that it will take him more than 10 minutes altogether to wait for the phone and complete his call?

(b) Patients arrive at a clinic according to a Poisson distribution at the rate of 30 patients per hour. The waiting room does not accommodate more than 14 patients. Examination time per patient is exponential with mean rate 20 per hour. (i) Find the effective arrival rate at the clinic. (ii) What is the

probability that an arriving patient will not wait? Will the find a vacant seat in the room? (iii) What is the expected waiting time until a patient is discharged from the clinic?

Simulation

3(a) A book store wishes to carry a particular book in stock. Demand is probabilistic and replenishment of stock takes 2 days (i.e. if an order is placed on March 1, it will be delivered at the end of the day on March 3). The probabilities of demand are given below:

Demand (daily) :	0	1	2	3	4
Probability :	0.05	0.10	0.30	0.45	0.10

Each time an order is placed, the store incurs an ordering cost of Rs 10 per order. The store also incurs a carrying cost of Rs 0.5 per book per day. The inventory carrying cost is calculated on the basis of stock at the end of each day. The manager of the book store wishes to choose the best one from three options for his inventory decision.

A: Order 6 books when the inventory at the beginning of the day plus orders outstanding is less than 8 books.

B: Order 5 books when the inventory at the beginning of the day plus orders outstanding is less than 8 books.

C: Order 8 books when the inventory at the beginning of the day plus orders outstanding is less than 8 books.

Currently (beginning of 1st day) the store has a stock of 8 books plus 6 books ordered two days and expected to arrive next day. Using Monte Carlo simulation for 10 cycles, recommend which option manager should choose.

The two digits random numbers are given below:

89, 34, 78, 63, 61, 81, 39, 16, 14, 73

(b) Dr X is a dentist who schedules all his patients for 30 minutes appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and time actually needed to complete the work:

Category of service	Time required (Minutes)	Probability
Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Checkup	15	0.20

Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8 am. Use the following random numbers for handling the above problem.

40 82 11 34 25 66 17 79

Ans

1. De

(a)

(c)

(e)

(g)

(i)

2. (a)

(b)

(c)

3. (a)

(b)

(c)

(c)

4. (a)

Department of Advanced Science and Technology

University of Computer Studies

Fourth Year (B.C.Sc./ B.C.Tech.)

Mid Term Examination

Mathematics of Computing IV (CST 402)

March, 2015

Zone IV

Time allowed: 3 hours.

Answer All Questions

1.(a) For the following linear systems of equations, solve or indicate that no solution exists. (Use Cramer's rule)

$$x + y - z = 9$$

$$8y + 6z = -6$$

$$-2x + 4y - 6z = 40$$

(b) Calculate the inverse of the matrix $A = \begin{bmatrix} 0.2 & 0.2 & 0 \\ -0.2 & 0.3 & 1 \\ 0.2 & -0.3 & 0 \end{bmatrix}$.

2.(a) Is the matrix $B = \begin{bmatrix} 0.766 & -0.643 \\ 0.643 & 0.766 \end{bmatrix}$ skew-symmetric or orthogonal? (Use 3D)

(b) Let $A = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$, $P = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$. Find $\widehat{A} = P^{-1}AP$, and eigenvectors y of \widehat{A} . Show that $x = Py$ are eigenvectors of A .

3.(a) Find a basis of eigenvectors that form a unitary system.

$$A = \begin{bmatrix} 1/2 & i\sqrt{3/4} \\ i\sqrt{3/4} & 1/2 \end{bmatrix}$$

(b) If $A = \begin{bmatrix} 1 & 3 & 0 \\ 3 & 10 & -3 \\ 0 & -3 & 9 \end{bmatrix}$, determine the three eigenvalues $\lambda_1, \lambda_2, \lambda_3$ of A and verify that if

$X = \begin{bmatrix} -9 & 1 & 1 \\ 3 & 2 & 4 \\ 1 & 3 & -3 \end{bmatrix}$, then $X^{-1}AX = D$ where D is a diagonal matrix with elements $\lambda_1, \lambda_2, \lambda_3$.

4.(a) Find out what type of conic section (or pair of straight lines) is represented by the given quadratic

form. Transform it to principal axes. Express $x^T = [x_1 \ x_2]$ in terms of the new coordinate vector $y^T = [y_1 \ y_2]$.

$$Q = x_1^2 + 4x_1x_2 + 4x_2^2 = 20$$

(b) Are the following sequences z_1, z_2, z_3, \dots convergent or divergent? Find their limit points.

$$(i) \ z_n = \frac{n^2 \pi}{(1+2n^2)^2} \quad (ii) \ z_n = \frac{1+\ln n}{\ln(n+1)}$$

5.(a)(i) Is the series $\sum_{n=1}^{\infty} 4n \left(\frac{1}{3}\right)^{n-1}$ convergent or divergent? Show the details.

(ii) Let $a_n = \frac{i}{3^{2n}}$ and $b_n = \frac{1}{3^{2n+1}}$. Is the following series convergent or divergent? Show the details.

$$a_0 + b_0 + a_1 + b_1 + \dots = i + \frac{1}{3} + \frac{i}{9} + \frac{1}{27} + \frac{i}{81} + \frac{1}{243} + \dots$$

(b) Find the center and radius of convergence of the following power series.

$$(i) \ \sum_{n=1}^{\infty} \frac{(-1)^n}{n2^n} (z - 1 - i)^n \quad (ii) \ \sum_{n=0}^{\infty} \frac{3^n(1-i)^n}{n!} z^n$$

Department of Advanced Science and Technology
University of Computer Studies
B.C.Sc.(Fourth Year)
Analysis of Algorithms (CS-403)
Mid Term Examination

March 2015

Zone IV

Time allowed : 3 hours.

Answer ALL questions.

1. (a) Define the followings : (8 marks)
 - (i) Bitwise computation
 - (ii) Expected time complexity
 - (iii) RAM
 - (iv) Recursion
- (b) Briefly explain the followings: (12 marks)
 - (i) Multitape Turing Machine
 - (ii) Random Access Stored Program Model (RASP)
 - (iii) Divide-and-conquer Approach
2. (a) Give Pidgin ALGOL and RAM program to read n positive integers followed by endmarker "0" and display the average of these numbers. (10 marks)
- (b) "If costs of instructions are either uniform or logarithm for every RAM program of time complexity $T(n)$ there is a constant k such that there is an equivalent RASP program of time complexity at most $kT(n)$." Prove the above statement. (10 marks)
3. (a) Simulate the following RAM instructions in RASP. (6 marks)
 - (i) LOAD * i (ii) WRITE * i
- (b) Specify a Turing Machine which recognizes palindromes on the alphabet {0,1}. Analyze the time and space complexity of that problem. (14 marks)
4. (a) Write the bitwise addition program to compute the sum of 2-bit and 3-bit integers. (6 marks)
- (b) **Describe Dynamic Programming.** Find the minimal number of operations in multiplying the following matrices using the dynamic programming algorithm below: (14 marks)

$$\begin{array}{cccc}
 M = M_1 & * & M_2 & * & M_3 & * & M_4 \\
 [5 \times 10] & & [10 \times 20] & & [20 \times 30] & & [30 \times 40]
 \end{array}$$

Also find the order of execution to multiply.

```

begin
 1. for i=1 until n do mii = 0;
 2. for l=1 until n-1 do
    begin
      3. for i = 1 until n-l do
        begin
          4. j = i + l;
          5. mij = MINi<=k<=j (mik + mk+1,j + ri-1 * rk * rj);
          6. write m1n;
        end;
    end;
  end;

```
5. (a) Sort the sequence $S = \{6, 3, 7, 9, 4, 5, 2\}$ using Heapsort algorithm. (10 marks)
- (b) Show that the expected running time of QuickSort algorithm is $O(n^2)$ and the worst-case running time of QuickSort is $O(n \log n)$ (10 marks)

the
b).
Answer all questions.

Department of Advanced Science and Technology

University of Computer Studies

B.C.Sc. (Fourth Year)

Mid Term Examination

CS- 404 (Database Management System)

March, 2015

Zone IV

Time allowed: 3:00 hours.

1. Write a short note on **Any FIVE** of the following:

(5 marks each)

- (a) Constraint Classification Scheme
- (b) Audit Trails
- (c) Distributed Database System
- (d) Local Autonomy
- (e) Star schema
- (f) Operation data store (ODS)
- (g) Primary Copy Update Scheme

2. Consider the following relational schema

S(S#, SNAME, STATUS, CITY)

P(P#, PNAME, COLOR, WEIGHT, CITY)

J(J#, JNAME, CITY)

SPJ(S#, P#, J#, QTY) (35 marks)

(a) Write the following integrity constraints by using appropriate language.

- (i) No shipment can have a quantity more than double the average of all such quantities.
- (ii) Every project must be located in a city in which there is at least one supplier of that project.
- (iii) All red parts must weigh less than 50 pounds.
- (iv) No two projects can be located in the same city.
- (v) At most one supplier can be located in Athens at any one time.

(b) For each of your answers to above question 2(a), state whether the constraints is a type constraint or relvar constraint or database constraint.

(c) Write the following security constraints by using appropriate language.

- (i) User David can retrieve the supplier numbers for suppliers who supply project J1.
- (ii) User Smith can delete and update the full details for parts supplied by a supplier in London.
- (iii) User Chang can update the color of parts supplied by supplier S1.
- (iv) User Amy can see the supplier numbers and status for supplier in Paris with status > 20.
- (v) User Michel can see and delete the full details of all projects in London.

3. Discuss R* Object naming scheme of the distributed database systems. (10 marks)

4. Define statistical database? Discuss the problem of statistical database security. (10 marks)

5(a) Consider the supplier-part-project database on above question (2), write the following queries using GROUP BY in SQL statement:

1. Get the total shipment quantity.
2. Get the total shipment quantities by supplier.
3. Get the total shipment quantities by part.
4. Get total shipment quantities by supplier and part.

(b) Write the above queries in question 5(a) by using GROUPING SET, ROLLUP and CUBE. (20 marks)

Answer all

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Department of Advanced Science and Technology
University of Computer Studies

B.C.Sc. (Fourth Year)

Mid-term Examination

CS-405 (Software Engineering)

March, 2015

Zone IV

Answer all questions.

Time allowed : 3 hours

1. Answer any four of the followings: (20 marks)

(a) What factors are used in application assessment?

(b) What major advantages are there inspections over testing?

(c) Discuss about stress testing

(d) What are the factors that affecting software engineering productivity?

(e) What activities are required for the software quality management for large systems?

2. (a) Explain about static software product metrics. (10 marks)

(b) Explain the interface testing is necessary even when individual components have been extensively validated through component testing and program inspections. (10 marks)

3. (a) The objective of path testing is to ensure that each independent path through the program is executed at least once. Explain the path testing techniques. (10 marks)

(b) Explain the debugging process that is often integrated with verification and validation activities. (10 marks)

(or)

Describe two metrics that have been used to measure programmer productivity. Comment briefly on the advantages and disadvantages of each these metrics.

4. (a) Testing is an expensive and laborious phase of the software process. Explain about the testing workbenches. (10 marks)

(or)

Reused model make estimation for generated code and the code that has to be understood and integrated. Describe their formulation and explain them.

(b) Describe the process of clean room strategy. (10 marks)

(or)

Describe about an overview of maintenance process and state the reasons for arising urgent changes.

5. (a) Explain the major components of test plan. (10 marks)

(or)

Write short note for any two of the followings:

- (i) Defect testing
- (ii) White box testing
- (iii) Stress testing

(b) What is software re-engineering? Discuss its key advantages. (10 marks)

(or)

Explain about Outline structure for a quality plan that suggested by Humphrey.

Ans

1.

(Answer 01)

2.

road over the following points in your answer:
(a) Explain the concept of quality plan.
(b) Explain the structure of quality plan.
(c) Explain the components of quality plan.
(d) Explain the process of quality plan.

3.

Explain the following:
(a) Quality plan
(b) Quality system
(c) Quality control
(d) Quality assurance

4.

Explain the following:
(a) Quality plan
(b) Quality system
(c) Quality control
(d) Quality assurance

Department of Advanced Science and Technology

University of Computer Studies

B.C.Sc. (Fourth Year)

Artificial Intelligence (CS-406)

Mid Term Examination

March 2015

Zone IV

Time Allowed : 3 hours.

Answer All questions.

1. Define the followings:

- | | |
|-------------------------|---------------------------------|
| (a) Atomic sentence | (b) Model checking |
| (c) Logical equivalence | (d) Fact |
| (e) Horns clauses | (f) Epistemological commitments |
| (g) Syntactic sugar | (h) Ground term |
| (i) Unification | (j) Occur Check |
- (20 marks)

2. (a) Explain three concepts that apply to all forms of propositional logic.
(b) Show that the following formulas are tautologies:
$$(A \Rightarrow B) \wedge (B \Rightarrow A) \Leftrightarrow (A \Leftrightarrow B)$$
- (c) Determine using a truth table whether the following sentence is valid, satisfiable, or unsatisfiable:

- (i) $((P \wedge Q) \Rightarrow R) \Leftrightarrow ((P \Rightarrow R) \vee (Q \Rightarrow R))$
(ii) $((P \Rightarrow (Q \vee R)) \wedge \neg(Q \vee R)) \Rightarrow \neg P$

(20 marks)

3. (a) Explain the five logical connectives which are commonly used in construction of complex sentences from simpler sentences.

- (b) Represent the followings knowledge base in first-order logic. Use the predicates: attend(x), fail(x, t), fair(t), pass(x, t), prepared(x), smart(x), study(x), UCS_student(x) where arguments x have the domain of all people, and arguments t have the domain of all tests.

- (i) Everyone who is smart, studies and attends class will be prepared.
(ii) Everyone who is prepared will pass a test if it is fair.
(iii) A student passes a test if and only if they don't fail it.
(iv) Every UCS student is smart.
(v) Laura is UCSY student.

- (c) Write axioms describing the predicates Grandchild, GreatGrandparent, Brother, Sister, Daughter, Son, Aunt, Uncle, BrotherInLaw, SisterInLaw, and Firstcousin. Find out the proper definition of mth cousin n times removed, and write the definition in first-order logic.

(20 marks)

4. (a) Consider the following problem:

The law says that it is a crime for an American to sell weapons to hostile nations. The country Nono, an enemy of America, has some missiles, and all of its missiles were sold to it by Colonel West, who is American.

Draw the proved tree constructed by backward chaining to prove that West is a criminal.

- (b) For each of the following pairs of atomic sentences, give the most general unifier, if it exists.

- (i) $\text{Knows}(\text{Father}(y), y), \text{Knows}(x, x)$
- (ii) $\text{Q}(y, \text{G}(A, B)), \text{Q}(\text{G}(x, x), y)$

- (c) Write down the logical representation for the following sentences, suitable for use with Generalized Modus Ponens.

- (i) Horses, cows and pigs are mammals.
- (ii) Every mammals has a parent.
- (iii) Bluebeard is Charlie's parent.

(20 marks)

5. (a) Let the following propositional symbols have the following meaning:

A John was in a car accident.

S John is sick.

I John is injured.

D John needs to see a doctor.

Express each of the following English sentences in propositional logic.

- (i) *John was in a car accident, but he isn't injured.*
- (ii) *John needs to see a doctor if he is sick or injured.*
- (iii) *If John wasn't in an accident and isn't sick, then he doesn't need a doctor.*

- (b) Two English sentences "Anyone who takes an AI course is smart" and "Any course that teaches an AI topic is an AI course" have been represented in first-order logic:

$$\forall x (\exists y \text{AI_course}(y) \wedge \text{Takes}(x, y)) \Rightarrow \text{Smart}(x)$$

$$\forall x (\exists y \text{AI_topic}(y) \wedge \text{Teaches}(x, y)) \Rightarrow \text{AI_course}(x)$$

It is also known that John takes CS3243 and CS3243 teaches Inference which is an AI topic. Represent these facts as first-order logic sentences. Now convert all first-order logic sentences into conjunctive normal form and use resolution to prove that "John is smart."

(20 marks)

Department of Advanced Science and Technology

University of Computer Studies

B.C.Tech. (Fourth Year)

Artificial Intelligence (CT-401)

Mid Term Examination

March 2015

Zone IV

Time Allowed : 3 hours.

Answer All questions.

1. Define the following:
(a) Knowledge level
(b) Atomic sentence
(c) Literal
(d) Unit clause
(e) AND-OR graph
(f) Syntactic sugar
(g) High order logic
(h) Diachronic
(i) Universal instantiation
(j) Semidecidable
(20 marks)
2. (a) Difference between declarative approach and procedural approach.
(b) Decide whether each of the following sentences is valid, unsatisfiable, or neither. Verify your decisions using truth tables.
(i) $((P \vee Q) \Rightarrow \neg R) \wedge (\neg R \vee (Q \vee P))$
(ii) $(\text{Smoke} \vee \text{Fire}) \Rightarrow ((\text{Smoke} \wedge \text{Heat}) \Rightarrow \text{Fire})$
(c) Consider a vocabulary with only four propositions, A, B, C, and D. How many models are there for the $A \Leftrightarrow B \Leftrightarrow C$ sentences?
(20 marks)
3. (a) Consider a knowledge base containing just two sentences: P(a) and P(b). Does this knowledge base entail $\forall x P(x)$? Explain your answer in terms of models.
(b) Represent the following English sentences in first-order logic.
(i) Parent and child are inverse relations.
(ii) The best score in Greek is always higher than the best score in French.
(iii) There is a barber who shaves all men in town who do not shave himself.
(iv) An object is in the intersection of two sets if and only if it is a member of both sets.
(v) A grandparent is a parent of one's parent.
(c) What is the problem in each of the following first order logic statements? Suggest how these statements can be corrected.
(a) $\forall x \text{Boy}(x) \wedge \text{Tall}(x)$
(Intended meaning: all boys are tall.)
(b) $\exists x \text{Boy}(x) \Rightarrow \text{Tall}(x)$
(Intended meaning: some boy is tall.)
(20 marks)
4. (a) Write down the logical representation for the following sentences, suitable for use with Generalized Modus Ponens.
(i) Horses, cows and pigs are mammals.
(ii) Offspring and parent are inverse relations.
(20 marks)

- (b) Attempt to unify the following pairs of expressions. Either shows their most general unifiers or explain why they will not unify.

- (i) $\text{Ancestor}(x, \text{Father}(y))$, $\text{Ancestor}(\text{David}, \text{George})$
- (ii) $\text{Older}(\text{Father}(y), y)$, $\text{Older}(\text{Father}(x), \text{John})$
- (iii) $Q(y, G(A, B))$, $Q(G(x, x), y)$

- (c) Convert the following knowledge base to conjunctive normal form:

- (i) $(P \Rightarrow (Q \Rightarrow R)) \Rightarrow (P \Rightarrow (R \Rightarrow Q))$
- (ii) $(A \Rightarrow B) \vee (B \Rightarrow A)$

(20 marks)

5. (a) Given the following, can you prove that the unicorn is mythical? How about magical? Horned?

If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned.

- (b) Sam, Clyde, and Oscar are rabbits. We know the following facts about them:

- 1. Sam is pink.
- 2. Clyde is gray and likes Oscar.
- 3. Oscar is either pink or gray (but not both) and likes Sam.

Use resolution refutation to prove that a gray rabbit likes a pink rabbit; that is, prove

$$(\exists x, y) [\text{Gray}(x) \wedge \text{Pink}(y) \wedge \text{Likes}(x, y)].$$

(20 marks)

Answer A

1.(a) For the rule)

(b) Calcul

2.(a) Is the

(b) Let A

eigen

3.(a) Find

(b) If A

$X =$

4.(a) Find

form

$y_2]$

(b) Are

(i) z

5.(a)(i) L

(ii)

(b) Fin

(i) z

Department of Advanced Science and Technology
University of Computer Studies
B.C.Tech. (Fourth Year)
Mid Term Examination
Electronics II (CT-403)
March, 2015

Answer all questions.

Zone IV

Time allowed: 3 hours

- 1 (a) (i) Determine the values of R_D and R_S required to self-bias an n-channel JFET having the transfer characteristic curve shown in Figure 1(a-i) at $V_{GS} = -5V$.
(ii) $I_{DSS} = 20 \text{ mA}$ and $V_{GS(\text{off})} = -6 \text{ V}$ for a particular JFET.
(a) What is I_D when $V_{GS} = 0\text{V}$?
(b) What is I_D when $V_{GS} = V_{GS(\text{off})}$?
(c) If V_{GS} is increased from -4V to -1V , does I_D increased or decreased.
(b) Determine V_{DS} and V_{GS} in Figure 1(b) and $I_D = 5\text{mA}$.

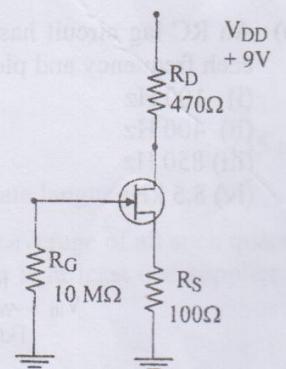
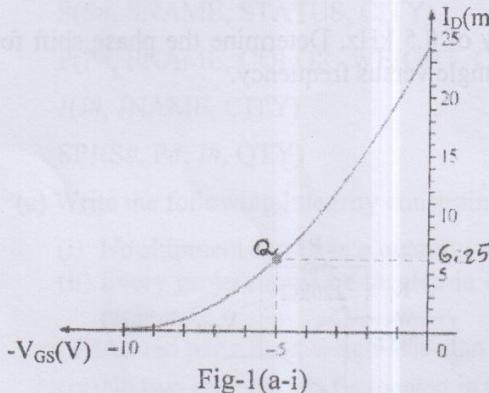
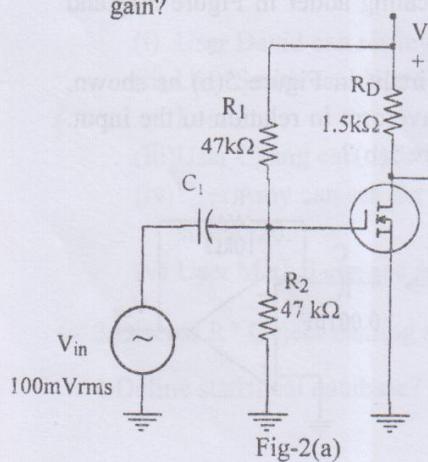
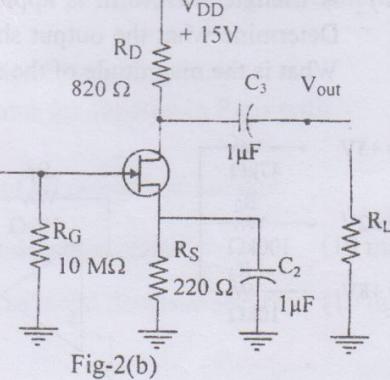


Fig-1(b)

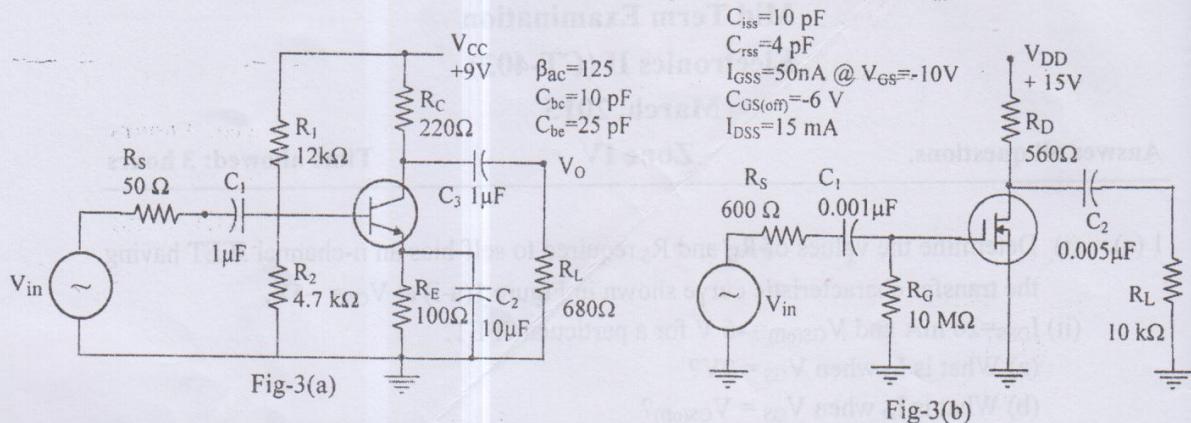
- 2 (a) For the unloaded amplifier in Figure 2(a), find V_{GS} , I_D , V_{DS} and the rms output voltage V_{ds} . $I_{D(\text{on})} = 8 \text{ mA}$ at $V_{GS} = 12 \text{ V}$, $V_{GS(\text{th})} = 4 \text{ V}$ and $g_m = 4500 \mu\text{S}$. (8 marks)
- (b) A $4.7 \text{ k}\Omega$ resistor is connected in parallel with R_L in Figure 2(b). What is the voltage gain?



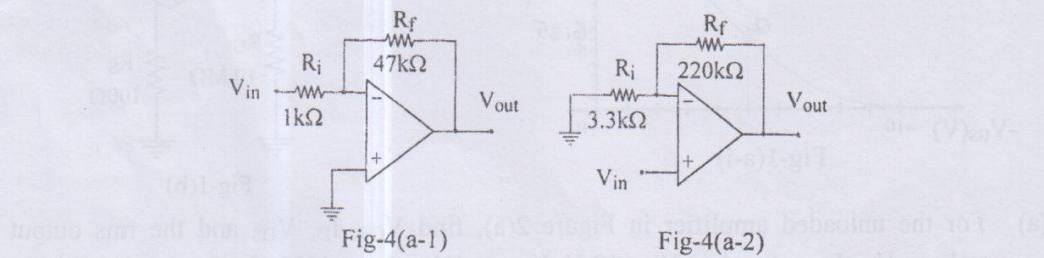
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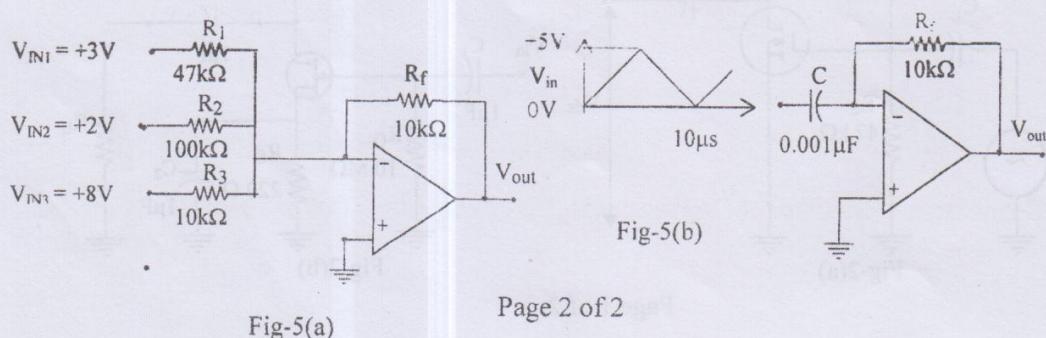
- 3 (a) Determine the critical frequencies associated with the low frequency response of the amplifier in Figure 3(a)
- (b) Determine the total low-frequency response of the FET amplifier in Figure 3(b). Assume that the load is another identical amplifier with the same R_{in} .



- 4 (a) Determine the bandwidth of each of the amplifiers in Figure 4(a). Both op-amps have an open-loop gain of 100dB and a unity-gain bandwidth of 3 MHz . (6 marks)
- (b) An RC lag circuit has a critical frequency of 8.5 kHz . Determine the phase shift for each frequency and plot a graph of phase angle versus frequency.
- 100 Hz
 - 400 Hz
 - 850 Hz
 - 8.5 kHz



- 5 (a) Determine the weight of each input voltage for the scaling adder in Figure 5(a) and find the output voltage.
- (b) A triangle waveform is applied to the input of the circuit in Figure 5(b) as shown. Determine what the output should be and sketch its waveform in relation to the input. What is the magnitude of the capacitor current in Figure 5(b)?



Department of Advanced Science & Technology
University of Computer Studies
Fourth Year B.C.Tech.
Mid-term Examination
Computer Architecture (CT 404)
March 2015

Answer all questions.

Zone IV

Time allowed: 3 hours

JP and
marks)

1. (a) (i) Write down the expressions for propagate and generate which are two auxiliary signals needed for carry-lookahead adders. (ii) Using these expressions, define the carries in a four-bit carry-lookahead adder. (iii) From the expressions in (ii), determine the adder's maximum delay for four-bit and n -bit inputs. (12 marks)
- (b) Illustrate the logic diagram of the 4-bit adder with overflow and zero flags from 1-bit adders providing access to the internal signals needed by overflow and zero flags. (4 marks)
2. (a) Consider to multiply 2 two's complement fractions where multiplier = 11010101 and multiplicand = 10110011 using the algorithm in Figure 1. (i) examine the required number of registers with their sizes. (ii) Observe how many times of addition, subtraction and just skip operations would be needed to multiply these two numbers. (8 marks)

```

BoothMult (in: INBUS; out: OUTBUS);
register A[7:0], M[7:0], Q[7:-1], COUNT[2:0],
bus INBUTS[7:0], OUTBUS[7:0];
BEGIN: A := 0, COUNT := 0;
        M := INBUS;
INPUT:  Q[7:0] := INBUS, Q[-1] := 0;
        if Q[0] Q[-1] = 01 then A[7:0] := A[7:0] + M[7:0], go to TEST
        else if Q[0] Q[-1] = 10 then A[7:0] := A[7:0] - M[7:0];
SCAN:   if COUNT = 7 then go to OUTPUT;
TEST:   if COUNT = 7 then go to OUTPUT;
RSHIFT: A[7] := A[7], A[6:0].Q := A.Q[7:0];
INCREMENT: COUNT = COUNT+1, go to SCAN;
OUTPUT: OUTBUS := A; Q[0] = 0;
        OUTBUS := Q[7:0];
end BoothMult

```

Figure 1 HDL Description of an 8-bit multiplier

- (b) A cell for array implementation of restoring division is given in Figure 2. (i) Using this divider cell, illustrate a divider array that is designed to handle a word size of $n = 3$ with a double length (6 bit) dividend unsigned integers to generate a 4-bit quotient. (ii) Suppose that dividends are restricted to 3 bits instead of 6, which cells can then be deleted from the array? (8 marks)

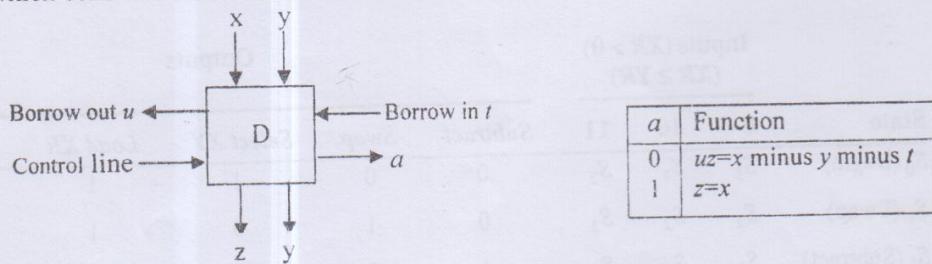


Figure 2. A cell D for array implementation of restoring division

3. (a) 74181 IC is a 4-bit ALU that implements 16 two-variable logic functions, as well as 16 arithmetic functions using propagate module, generate module and 4-bit carry-lookahead generator. Suppose IP,

IG and IC are 4-bit signals produced by above modules, (i) define an expression for data output function F . What would be F when it is (ii) in arithmetic mode, (iii) in logic mode?

(8 marks)

6. Figure associated with write do

(b) Floating-point arithmetic can be implemented by two loosely connected fixed-point datapath circuits: an exponent unit and a mantissa unit. Outline the structure of a floating-point unit employing this approach and explain its operation.

(8 marks)

4. (a) Based on throughput, clock cycle per instruction (CPI) and delay, discuss the behavioral characteristics of an m -stage pipeline.

(8 marks)

(b) Consider the task of multiplying two n -bit fixed point binary numbers $X = x_{n-1}x_{n-2} \dots x_1x_0$ and $Y = y_{n-1}y_{n-2} \dots y_1y_0$. Using 1-bit multiply-and-add cell M , (i) design a multiplier pipeline using carry propagation for $n = 3$ and (ii) determine the number of M cell needed and capacity of all the buffer registers.

(8 marks)

5. (a) (i) Internal structure of processor composed of a datapath unit DP and a control unit CU is given in Figure 3. (i) Define type of control signals that CU must activate that implement an addition instruction of the form ADD A, B which is written as $A := A + B$; in HDL notation, (ii) Show the control signals and data routing during the clock cycle in which the ADD A, B instruction is executed.

(8 marks)

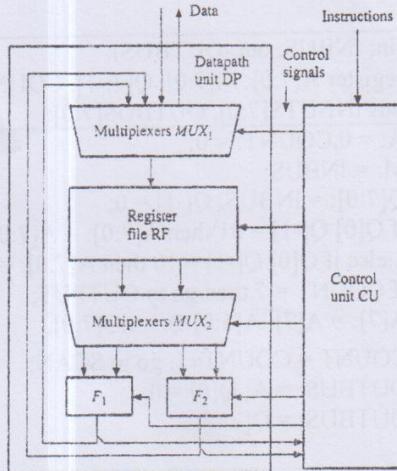


Figure 3. Processor composed of a datapath unit and control unit

- (b) State table defining the control unit of the gcd processor is given in Figure 4. Obtain the next-state and output equation to this gcd processor using one-hot method.

(10 marks)

State	Inputs ($XR > 0$) ($XR \geq YR$)			Outputs				
	0-	10	11	Subtract	Swap	Select XY	Load XR	Load YR
S_0 (Begin)	S_3	S_1	S_2	0	0	1	1	1
S_1 (Swap)	S_2	S_2	S_2	0	1	0	1	1
S_2 (Subtract)	S_3	S_1	S_2	1	0	0	1	0
S_3 (End)	S_3	S_3	S_3	0	0	0	0	0

Figure 4. State table defining the control unit of the gcd processor

data output
(8 marks)

nt datapath employing (8 marks)

**behavioral
(8 marks)**

.. $x_1 x_0$ and
line using
of all the
(8 marks)

U is given
n addition
Show the
raction is
(8 marks)

6. Figure 5 shows the flow chart of 8-bit twos-complement multiplier together with states and associated control signals activated. Construct a state table from this multiplier control unit and also write down the next state and output equations.

(18 marks)

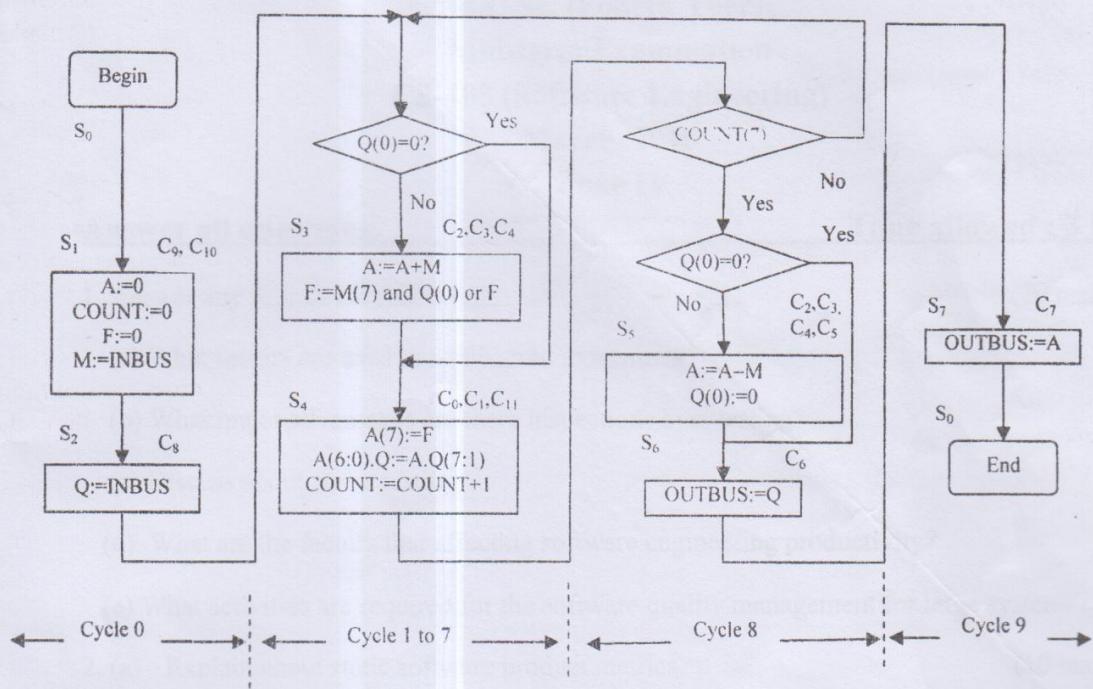


Figure 5. Flowchart for the twos-complement multiplier

Department of Advanced Science and Technology
University of Computer Studies
B.C.Tech. (Fourth Year)
Mid-Term Examination
Linear Control System II (CT-405)
March, 2015

Answer all questions.

Zone IV

Time allowed: 3 hours

1. The world's largest telescope is located in Hawaii. The primary mirror has a diameter of 10 m and consists of a mosaic of 36 hexagonal segments with the orientation of each segment actively controlled. This unit feedback system for the mirror segments has

$$G(s) = \frac{K}{s(s^2 + 2s + 5)}$$

- (i) Find the asymptotes and draw them in the s-plane.
- (ii) Find the angle of departure from the complex poles.
- (iii) Determine the gain when two roots lie on the imaginary axis.
- (iv) Sketch the root locus.

2. A unity feedback system has a loop transfer function

$$L(S) = G_C(s)G(s) = \frac{K}{s(s+3)(s^2 + 6s + 64)}$$

- (i) Determine the angle of departure of the root locus at the complex poles.
- (ii) Sketch the root locus.
- (iii) Determine the gain K when the roots are on the $j\omega$ -axis and determine the location of these roots.

3. A unity feedback control system has a plant

$$G(s) = \frac{1200}{s(s+2)(s+50)}$$

- (i) Sketch the asymptotic logarithmic magnitude and phase angle curves for this system.
- (ii) Estimate the gain and phase margins of this system.

4. A tendon-operated robotic hand can be implemented using a pneumatic actuator. The actuator can be represented by

$$G(s) = \frac{5000}{(s+70)(s+500)}$$

Plot the frequency response of $G(j\omega)$ is -17dB at $\omega=10$ and -27.1 dB at $\omega=200$. Show also that the phase is -138.7° at $\omega=700$.

5. A feedback control system has a loop transfer function: $GH(s) = \frac{K}{s(s+3)}$. It is desired to have a steady-state error for a ramp input equal to 5 % of the magnitude of the ramp. Furthermore we desire that the phase margin of the system be at least 45° . Design a phase-lag compensator on the **Bode** diagram.
6. The single-loop feedback control system is shown in Figure 6. The **lead compensation** network is added to get the following specifications:
- Settling time ≤ 4 sec
 - Percent overshoot for a step input $\leq 35\%$
 - Find the lead compensator using the Root Locus.

Answer

- Def (a)
- (c)
- (e)
- (g)
- (i)

- (a)
- (b)
- (c)

- (a)
- (b)
- (c)

- (a)

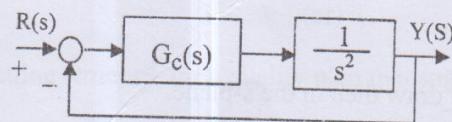


Figure 6

* * * * *

$(s+2)(s+1)(s+3)$

$(s+2)(s+1)(s+3)$