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Roll No. ....

**TMC-301**

**M. C. A. (THIRD SEMESTER)**  
**END SEMESTER**

**EXAMINATION, Dec, 2022**  
**DESIGN AND ANALYSIS OF ALGORITHM**

**Time : Three Hours**

**Maximum Marks : 100**

- Note :**
- (i) All questions are compulsory.
  - (ii) Answer any *two* sub-questions among (a), (b) and (c) in each main question.
  - (iii) Total marks in each main question are twenty.
  - (iv) Each sub-question carries 10 marks.

1. (a) The recurrence  $T(n) = 7T(n/3) + n^2$  describes the running time of an algorithm A. Another competing algorithm B has a running time of  $S(n) = aS(n/9) + n^2$ . What is the smallest value of 'a' such that A is a faster than B. (CO1)

**P. T. O.**

- (b) Among Merge sort, Insertion sort and Quick sort which sorting technique is the best in worst case. Apply the best one among these algorithms to sort the list E, X, A, M, P, L, E in alphabetic order. (CO1)
- (c) What do you understand by stable and unstable sorting ? Sort the following sequence : {25, 57, 48, 36, 12, 91, 86, 32} using heap sort. (CO1)
2. (a) Define Red-Black tree and its properties. Discuss the various cases for insertion of key in red-black tree for given sequence of key in an empty red-black tree :{15, 13, 12, 16, 19, 23, 5, 8}. (CO2)
- (b) Insert the following information F, S Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X, Y, D, Z, E, G, I. Into an empty B-tree with degree  $t = 3$ . (CO2)
- (c) Explain properties of Binomial Heap. Write an algorithm for union of two Binomial Heaps and write its time complexity. (CO2)

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3. (a) What is Knapsack problem ? Solve Fractional knapsack problem using greedy programming for the following four items with their weights  $w = \{3, 5, 9, 5\}$  and values  $P = \{45, 30, 45, 10\}$  with knapsack capacity is 16. (CO3)
- (b) What is N queens' problem ? Draw a state space tree for 4 queens problem using (CO3)
- (c) Discuss the dynamic problem solution for longest common sequence (LCS) problem. Write an algorithm to compute LCS of two given strings. (CO3)
4. (a) Define spanning tree. Write Kruskal's algorithm for finding minimum cost spanning tree. Describe how Kruskal's algorithm is different from Prim's algorithm for finding minimum cost spanning tree. (CO4)
- (b) Give Floyd War shall algorithm to find the shortest path for all pairs of vertices in a graph. Give the complexity of the algorithm and also explain with example. (CO4)

- (c) Explain Dijkstra algorithm to solve single source shortest path problem with suitable example. (CO4)
5. (a) Show the comparisons the native-string matcher makes for the pattern  $P = \{10001\}$  in the text  $T = \{0000100010010\}$  and also show the worst case time to find the first occurrence of the pattern in the text is  $O(n - m + 1)(m)$ . (CO5)
- (b) Define the following and relationship between them : (CO5)
- (i) P and NP class
  - (ii) NP-complete class
  - (iii) KMP string matching algorithm
- (c) Explain the following : (CO5)
- (i) Hamiltonian Cycle
  - (ii) Fast Fourier Transform
  - (iii) Approximation Algorithms

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**M. C. A. (THIRD SEMESTER)**

**MID SEMESTER EXAMINATION, 2022**

**DESIGN AND ANALYSIS OF ALGORITHM**

**Time : 1½ Hours**

**Maximum Marks : 50**

**Note :** (i) Answer all the questions by choosing

any *one* of the sub-questions.

(ii) Each question carries 10 marks.

1. (a) What do you understand by recursive and non-recursive algorithms ? Write steps to analyze time complexity of recursive algorithms with the help of an example.

**(CO1)**

**P. T. O.**

OR

- (b) Explain loop invariant in Quick Sort partition algorithm and implement Quick Sort on the given array : (CO1)

15	28	12	7	6	20	48	25
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2. (a) Define Red-Back tree and its properties. Explain why sentinel value is used in RB tree. (CO1, CO2)

OR

- (b) What do we use asymptotic notation in the study of algorithm ? Explain in brief various asymptotic notations and give their significance. (CO1, CO2)

3. (a) Write an algorithm for in-order and pre-order traversal. Also analyze its time and space complexity. (CO1, CO2)

OR

- (b) Let A [1 ..... n] be an array of  $n$  distinct number. If  $i < j$  and  $A[i] > A[j]$ , then pair  $(i, j)$  is called inversion of A.

(3)

Write an algorithm to determine the number of inversions in A in  $\Theta(n \log n)$  worst case time. (CO1, CO2)

4. (a) Explain a search procedure using divide and conquer technique. Prove that the procedure works correctly. Give the time complexity of the algorithm. (CO1)

OR

- (b) Write Master's method for solving recurrence relation of different types.
- (CO1)

5. (a) Sort the following array using merge sort.  
Show all computations : (CO1)

15	28	12	7	6	20	48	25	10
----	----	----	---	---	----	----	----	----

OR

- (b) Prove that any comparison sort algorithm require  $\Omega(n \log n)$  comparison in worst case. (CO1)

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**M. C. A. (THIRD SEMESTER)  
END SEMESTER  
EXAMINATION, Dec., 2022**

**AUTOMATA THEORY AND COMPILER  
CONSTRUCTION**

**Time :Three Hours**

**Maximum Marks : 100**

- Note :** (i) All questions are compulsory.  
(ii) Answer any *two* sub-questions among  
(a), (b) and (c) in each main question.  
(iii) Total marks in each main question are  
**twenty.**  
(iv) Each sub-question carries 10 marks.

**1. (a) Illustrate finite automata. Design a DFA  
for the following language over  
 $\Sigma = \{a, b\}$  : (CO1)**

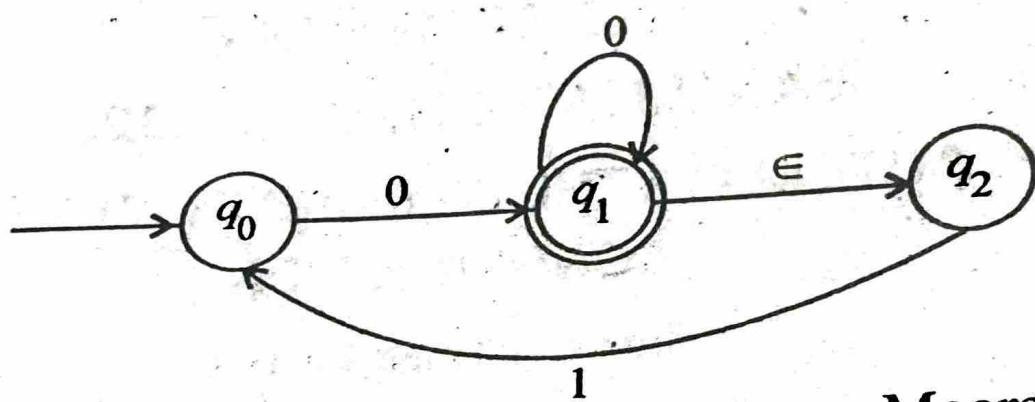
- (i) having odd number of 'a'**

(2)

(ii) having even number of 'a' and even number of 'b'

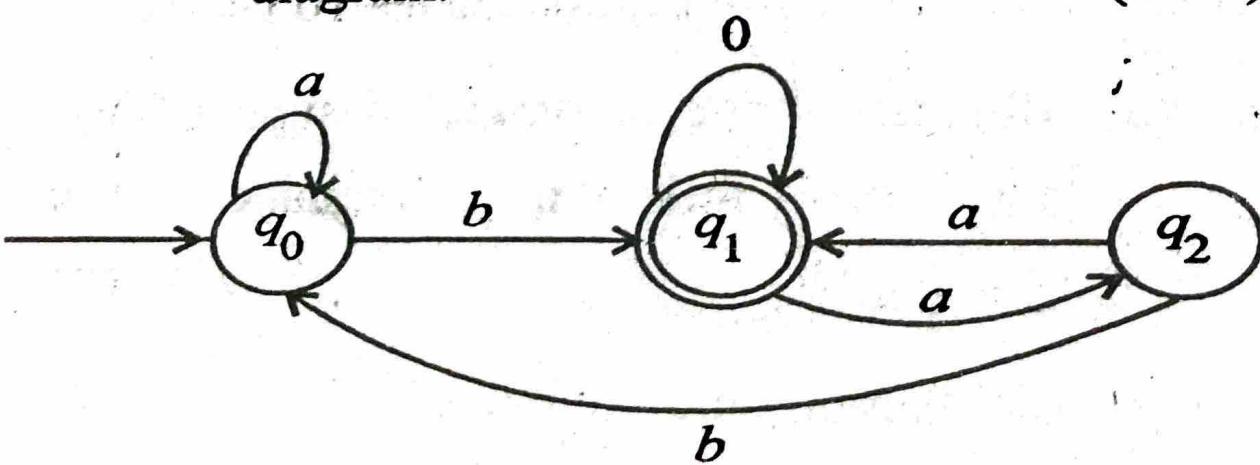
(iii)  $L = \{b^m ab^n : m, n \geq 0\}$

(b) Construct DFA equivalent to the following NFA : (CO1)



(c) Discuss and differentiate between Moore and Mealy machine. Design a Mealy machine which will increment the given binary number by 1. (CO1)

2. (a) Prove the Arden's theorem. Find the regular expression for the given transition diagram. (CO2)



(3)

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- (b) What do you mean by an ambiguity ?  
Show that  $S \rightarrow aS|Sa|a$  is an ambiguous grammar. (CO2)
- (c) Explain PDA. Design a deterministic PDA which accepts a language : (CO2)

$$L = \{0^n 1^{2n} : n \geq 0\}$$

3. (a) Illustrate the different phases of compiler using one example. (CO3)
- (b) What is the role of lexical analyzer ? How many tokens will be generated by lexical analyzer for the following expressions :
- (CO3)

- (i) printff ("Total = %d", i);  
(ii) int a [4] [5];  
(iii) if  $i \geq j$ , then goto 100;

- (c) Compute the FIRST and FOLLOW function for the following grammar :
- (CO3)

$$S \rightarrow ACB|CbB|Ba$$

$$A \rightarrow da|BC| \in$$

$$B \rightarrow g| \in$$

$$C \rightarrow h| \in$$

P. T. O.

(4)

4. (a) Show that following grammar is not SLR : (CO4)

$$S \rightarrow Aa \mid bAc \mid dc \mid bda$$

$$A \rightarrow d$$

- (b) Write the short notes on LEX and YACC. (CO4)

- (c) Explain synthesized attribute and inherited attribute with suitable example. (CO4)

5. (a) Define symbol table. How symbol table is used by various phases of compiler. (CO5)

- (b) Explain local optimization with suitable example. (CO5)

- (c) Write the three address code for the following : (CO5)

(i) for ( $i = 1; i \leq 10; i++$ )

{

$a[i] = x * 5;$

(ii) while ( $i < 10$ )

{

$x = 0;$

$i = i + 1;$

}

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**M. C. A. (THIRD SEMESTER)  
MID SEMESTER EXAMINATION, 2022**

**AUTOMATA THEORY AND COMPILER  
CONSTRUCTION**

**Time : 1½ Hours**

**Maximum Marks : 50**

**Note :** (i) Answer all the questions by choosing any *one* of the sub-questions.

(ii) Each question carries 10 marks.

1. (a) Define the term Automaton with an example. Distinguish between DFA and NFA with suitable example. (CO1)

**OR**

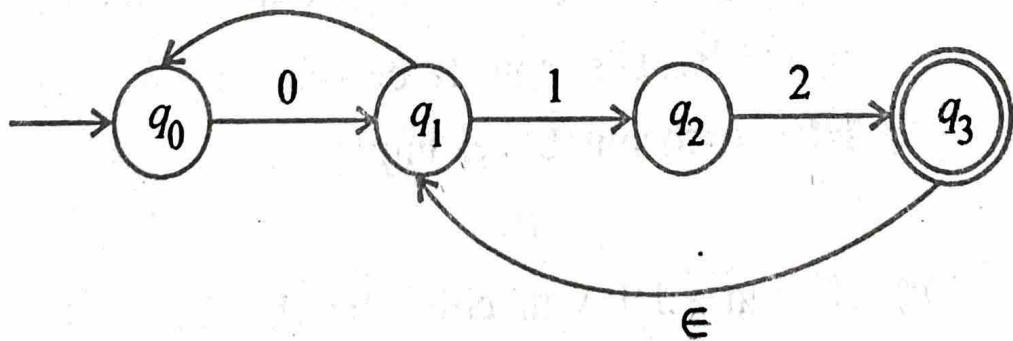
- (b) Design a DFA machine for the following languages : (CO1)

- (i) The language  $L = \{w \mid w \in \Sigma^* \text{ and } w \text{ ends with } 00\}$

(2)

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- (ii) The language  $L = \{w \in \Sigma^* \mid w$   
 contains the substring 1010}
- (iii) The language  $L = \{w \in \Sigma^* \mid w$  is a  
 string of 0 and 1 ending with 00}
2. (a) Design an NFA machine for the following  
 languages : (CO1)
- (i)  $L = \{a^n : n \geq 0\} \cup \{b^n a : n \geq 1\}$   
 with only four states.
- (ii)  $L = (ab \cup aba)^*$
- OR
- (b) Construct a DFA equivalent to the  
 following NFA : (CO1)



3. (a) Explain Moore machine. Construct a  
 Moore machine to determine the residue  
 mod 3 for a binary number. (CO1)

OR

- (b) Construct a Mealy machine which is equivalent to the following Moore machine : (CO2)

Current State	Next State		Output
	Input 0	Input 1	
q0 (start state)	q1	q2	1
q1	q3	q2	0
q2	q2	q1	1
q3	q0	q3	1

4. (a) Explain Chomsky classification of language with a suitable example. (CO2)

OR

- (b) Obtain the regular expression for the following languages : (CO2)

$$(i) \ L = \{a^{2n} b^{2m+1} \mid n \geq 0, m \geq 0\}$$

$$(ii) \ \{a^{2n+1} \mid n \geq 0\}$$

$$(iii) \ L = \{a^n b^n \mid n \geq 0\}$$

5. (a) Explain the use of pumping lemma. Show that the language  $L = \{a^n b^n c^n : n \geq 0\}$  is not a context free language. (CO2)

P. T. O.

OR

- (b) Explain Push down automata. How many types of representation of PDA ? In how many ways does PDA accept a string ? Explain with a suitable example. (CO2)

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## TMC-305

M. C. A. (THIRD SEMESTER)

MID SEMESTER EXAMINATION, 2022

FULL STACK WEB DEVELOPMENT

Time : 1½ Hours

Maximum Marks : 50

Note : (i) Answer all the questions by choosing any *one* of the sub-questions.

(ii) Each question carries 10 marks.

1. (a) What is the use of drag and drop features of HTML5 ? Create *two* images and drag the drop the images on the same web page.

10 Marks (CO1)

OR

(b) What is MathML in HTML5 ? Print the following equations using HTML5 code :

10 Marks (CO1)

$$(i) (a + b)^2 = a^2 + b^2 + 2ab$$

$$(ii) a/b - c/d = e/f$$

(2)

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2. (a) What is the use of SVG in HTML5 ?  
Create a cubic Bezier curve on the same path using SVG. Also specify the height and the width of the SVG to be 300 units.
- 10 Marks (CO1)
- OR
- (b) Differentiate between SVG and Canvas.  
Create a rectangle with a height = 100 units and width = 200 units. Also fill the four different colors inside rectangle using linear gradient.
- 10 Marks (CO1)
3. (a) What is the use of Bootstrap CSS ? What are the advantages of using bootstrap ?
- 10 Marks (CO2)

OR

- (b) What do you mean by transform in CSS ?  
Explain all the methods of 2d and 3d transform in detail. 3d transform an element into 60 degrees and move 200px from the original position where the origin of the transformation is center-center.

10 Marks (CO2)

(3)

4. (a) What are media queries in CSS ? Create a responsive web page for paged media query without using bootstrap.

10 Marks (CO2)

OR

- (b) What is CSS3 gradient ? Explain its types in detail with suitable example.

10 Marks (CO1)

5. (a) Explain in detail the HTML5 audio and video elements with all the attributes. How to load the audio and video loop in your web page ?

10 Marks (CO2)

OR

- (b) What do you mean by responsive web page ? Create a responsive photo gallery using bootstrap.

10 Marks (CO2)

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**TMC-305**

**M. C. A. (THIRD SEMESTER)**

**END SEMESTER**

**EXAMINATION, Dec, 2022**

**FULL SACK WEB DEVELOPMENT**

**Time :Three Hours**

**Maximum Marks : 100**

- Note :** (i) All questions are compulsory.
- (ii). Answer any *two* sub-questions among (a), (b) and (c) in each main question.
- (iii) Total marks in each main question are **twenty**.
- (iv) Each sub-question carries 10 marks.
1. (a) What are the new features of HTML 5 ?  
✓ Explain the new form controls in Web Form 2.0 with proper example. (CO1)
- (b) What is geolocation in HTML5 ? How does HTML5 geolocation work ? Explain with the help of code snippet. (CO1)

**P. T. O.**

- (c) What is the use of web storage in HTML5 ? Differentiate between web storage and cookies. Write a program to create local storage. (CO1)
2. (a) What is bootstrap grid system. How many classes are present in bootstrap grid system explain with suitable example. (CO2)
- (b) Explain the CSS positioning properties in detail. Create a web page which contains four <div> elements and implement all CSS positioning properties to properly position these elements and create layers of elements from one to four where the z-index can vary accordingly. (CO2)
- (c) What is animation in CSS. Write a program to binds the "sample" animation to the <div> element. The animation will last for 4 seconds, and it will gradually change the background-color of the <div> element from "red to green" and "green to yellow", and it retain the style values from

the last keyframe when the animation ends. (CO2)

3. (a) What is the use of regular expressions in JavaScript ? Validate a student registration form using regular expression, where : (CO3)

- (i) User Name contains name with 'GEHU' as a pattern
- (ii) Password should be alphanumeric
- (iii) Phone number

- (b) What are the directives in AngularJs ? Explain the MVC architecture of AngularJs in detail. Write a program to show two-way data binding using AngularJS directives. (CO3)

- (c) What is XML ? Explain how to write an XML document ? Explain the XML grammar in detail. (CO3)

4. (a) What do you mean by NPM in node.js ? write a program to create, insert and update a database using MongoDB. (CO4)

(b) Explain the purpose of module.exports.  
create a module named as "function.js"  
and access the module in the application  
"index.js". (CO4)

(c) What is Node.js ? How does it work ?  
Explain REPL in the context of Node.js.  
(CO4)

5. (a) What is a content management system  
used for ? What are the advantages of  
content management system ? Write down  
the steps how to create a website using  
WordPress. (CO5)

(b) What do you mean by web application  
deployment ? How to deploy a static  
website using FTP ? (CO5)

(c) What is Elastic beanstalk ? How to deploy  
serverless applications and deployment  
using Elastic beanstalk. (CO5)

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**TMC-304**

**M. C. A. (THIRD SEMESTER)  
END SEMESTER  
EXAMINATION, 2022**

**IMAGE PROCESSING AND COMPUTER  
VISION**

**Time :Three Hours**

**Maximum Marks : 100**

- Note :** (i) All questions are compulsory.
- (ii) Answer any *two* sub-questions among (a), (b) and (c) in each main question.
- (iii) Total marks in each main question are twenty.
- (iv) Each sub-question carries 10 marks.
1. (a) Explain in detail the various steps in Digital image processing with a neat diagram. (CO1)

**P. T. O.**

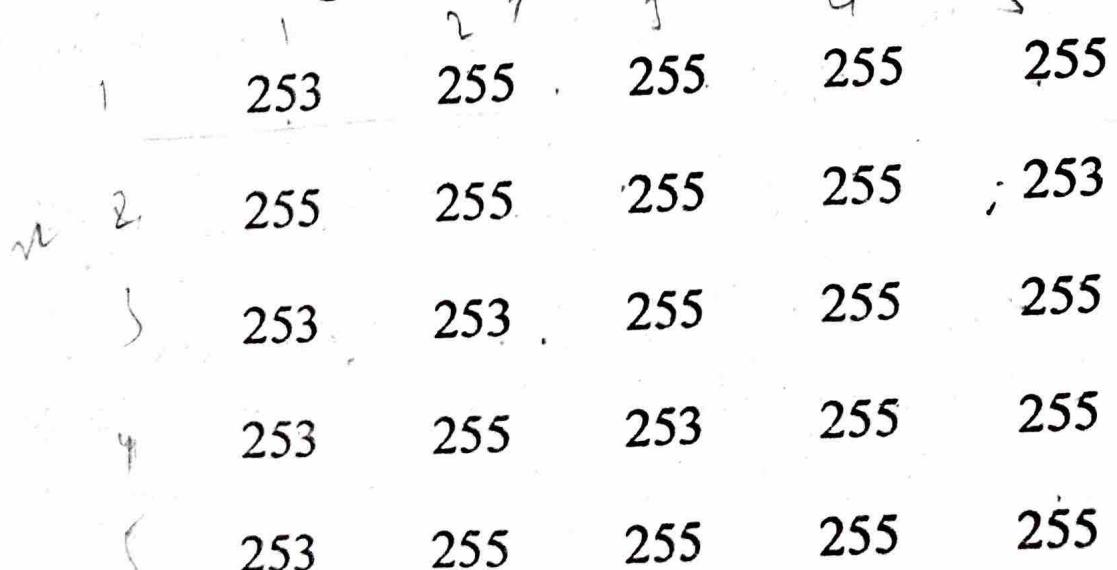
(2)

- (b) What do you mean by adjacency ?  
 Differentiate between 4, 8 and M adjacency.  
 (CO1)

- (c) Consider the two image subsets  $S_1$  and  $S_2$  shown in the following figure. For  $V = \{1\}$ , determine whether these two subsets are (i) 4-adjacent, (ii) 8-adjacent, or (iii)  $m$ -adjacent.  
 (CO1)

	$S_1$				$S_2$				
0	0	0	0	0	0	0	1	1	0
1	0	0	1	0	0	1	0	0	1
1	0	0	1	0	1	1	0	0	0
0	0	1	1	1	0	0	0	0	0
0	0	0	1	1	0	0	1	1	1

2. (a) Draw the histogram of the image given below. Is it required to equilibrate this histogram ?  
 (CO2)



- (b) Explain Spatial filtering in detail. What are the non-linear filters used for Image Enhancement. (CO2)
- (c) Differentiate between Correlation and Convolution with an example. (CO2)
3. (a) Explain Gaussian, Gamma, Salt and Pepper and, Rayleigh noise emphasizing on its probability distribution function. (CO3)
- (b) Sketch the RGB components of the following colours as they would appear on a monochrome monitor. (CO3)
- |       |     |        |       |      |      |         |       |      |
|-------|-----|--------|-------|------|------|---------|-------|------|
| Black | Red | Yellow | Green | Cyan | Blue | Magenta | White | Gray |
|-------|-----|--------|-------|------|------|---------|-------|------|
- (c) Explain RGB colour model with a neat diagram. (CO3)
4. (a) Compress the symbols given below using Huffman Coding. (CO4)

S1	0.25
S2	0.21
S3	0.15
S4	0.14
S5	0.0625
S6	0.0625

- (b) What do you mean by image morphology ? Differentiate between opening and closing. (CO4)
- (c) Explain Spatial and Temporal redundancy in detail with an example. (CO4)
5. (a) What do you mean by Pattern Matching ? Explain the commonly used pattern arrangements. (CO5)
- (b) What do you mean by Image Segmentation ? Explain the different approaches for image segmentation. (CO5)
- (c) Explain the regional description in detail. (CO5)