M.Sc. CSc.564-2072 ✡

Tribhuvan University
Institute of Science and Technology
2072
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Master Level / First Year/ 2nd Semester/ Science
Computer Science and Information Technology (CSc. 564)
(Data Warehousing and Data Mining)

Full Marks: 45
Pass Marks: 22.5
Time: 2 hours.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Group A

Attempt any two questions. (10×2=20)

1. Difference between operational database and data warehouse. Given the following table find the chances of having same diseases among Jack, Mary and Jim.

Name	Gender	Fever	Cough	Test - 1	Test - 2	Test - 3	Test - 4
Jack	M	Y	N	P	N	N	N
Mary	F	Y	N	P	N	P	N
Jim	M	N	P	N	N	N	N

2. Describe the steps in classification. Explain how Bayesian classifier classifies the data with example.

3. List the constraints in data mining. How is class comparison performed? Explain the steps.

Group B

Attempt ALL questions. (5×5=25)

4. Describe the basic principles of Attribute-Oriented Induction.

5. Explain Bottom Up Computation (BUC) algorithm.

6. Explain the general strategies for cube computation.

7. Explain the four natures of data warehouse.

8. Describe in brief (**Any TWO**):
   a) KDD vs Data Mining
   b) Data Transformation
   c) DBSCAN

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Master Level / First Year/ 2nd Semester/ Science
Computer Science and Information Technology (CSc. 558)
(Compiler Optimization)

Full Marks: 45
Pass Marks: 22.5
Time: 2 hours.

Candidates are required to give their answers in their own words as for as practicable.
The figures in the margin indicate full marks.

Group A

Attempt any two questions. (10 x 2 = 20)

1. Apply normalization, induction variable substitution and constant folding to the following loop:

```
IS = 5
DO I = 1, 100
        IS = IS + 10
        DO J = 2, 200, 3
                A(IS) = B(I) + C(J)
                IS = IS + 1
        ENDDO
ENDDO
```

2. Explain the branch removal algorithm.
3. Explain the inter-procedural optimization techniques with example.

Group B

Attempt all questions. (5 x 5 =25)

4. Explain the importance of optimization in compilers design.
5. Explain the conditions of variant of SIV testing.
6. Explain the distance and direction vectors with an example.
7. Explain the loop carried and loop independence dependence with example.
8. Explain the scalar expansion technique with example.

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Master Level / First Year/ 2nd Semester/ Science
Computer Science and Information Technology (CSc. 561)
(Machine Learning)

Full Marks: 45
Pass Marks: 22.5
Time: 2 hours.

Candidates are required to give their answers in their own words as for as practicable.
The figures in the margin indicate full marks.

Group A

Attempt any two questions. (10 x 2=20)

1. Describe the LMS (least mean square) algorithm and its variations (batch gradient descent and stochastic gradient descent).

2. Define the mixture of Gaussians model with suitable plot. Explain why latent random variable makes the estimation problem difficult.

3. Define the terms associated with Markov decision processes (MDP) that formalizes the reinforcement learning with concrete example.

Group B

Attempt All questions. (5 x 5=25)

4. Let $M=\{M_1, M_2, \ldots..M_d\}$ a finite set of models and S is a given training set. Based on these assumptions, explain the problem associated with the following model selection algorithm:
   Step 1- Train each model M_i on S to get some hypothesis h_i.
   Step 2- Pick the hypothesis with the smallest training error.

5. Describe the concept of functional and geometric margin used for optimal margin classifier. List the optimization problem for optimal margin classifier.

6. Define Karush-Kuhn-Tucker (KKT) conditions used for Lagrange duality. Explain when the value of the primal problem (p*) is equal to the value of the dual problem (d*).

7. What is principal component analysis (PCA) model? Explain the application areas of PCA algorithm.

8. Write short notes on:
   a. Naïve Bayes (NB) assumption.
   b. Reinforcement learning.

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Master Level / First Year/ 2nd Semester/ Science
Computer Science and Information Technology (CSc. 559)
(Web Systems and Algorithm)

Full Marks: 45
Pass Marks: 22.5
Time: 2 hours.

Candidates are required to give their answers in their own words as for as practicable.
The figures in the margin indicate full marks.

Group A

Attempt any two questions. (10 x 2 = 20)

1. Why does ROCK algorithm rock? Explain the algorithm of DBSCAN.
2. Why does the ranking on same query by different people may differ? Explain in your own view. How can be documents without links can be ranked?
3. Recommending new item is a crucial task. Why? Differentiate between collaborative and content based recommendation system.

Group B

Attempt ALL questions. (5 × 5 = 25)

4. How can link based algorithm can be used in clustering.
5. How does semantic web contribute on intelligent application? Explain.
6. Explain the algorithm of classification by decision tree.
7. Explain different test to compare multiple classifier.
8. Describe in brief **(Any two)**:
   a. Fallacies of Intelligent applications
   b. Classification with very large data sets
   c. Ontology

M.Sc.CSc. 554-2072 ✡

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Master Level / First Year/ IInd Semester/ Science
Computer Science and Information Technology (CSc. 554)
(Computational Geometry)
OLD COURSE

Full Marks: 60
Pass Marks: 30
Time: 3 hours.

Candidates are required to give their answers in their own words as for as practicable.
The figures in the margin indicate full marks.
Attempt all Questions.

1. How can you define visibility inside a polygon? Suppose you are given a rectilinear polygon, having edges parallel to either x-axis or y-axis, realizing Fisk's proof how many guards are needed to guard the polygon? Justify your answer. (2+4)

2. How each of the endpoint and intersection events are handled in sweep-line algorithm for segment intersection? What data structures are maintained while handling those events? Illustrate with proper example. (6)

3. Write an algorithm for ray crossing method for determining point inclusion in a polygon. Determine the complexity of your algorithm. How efficient is this from the winding number approach? (3+1+2)

4. Describe how regular vertices and end vertices are handled in plane-sweep algorithm for trapezodaliation? Configure a non-monotone and show the two cases. (6)

5. Briefly discuss the application areas of triangulation. How Incone test can be used to determine the diagonals of a polygon? Illustrate with an example. (2+4)

6. Given a cube in 3D how can you represent it using DCEL data structure? Which algorithm you prefer to find the convex hull of the cube? Why? (4+2)

7. How can you justify that for any two point sites a and b from a set of point sitesP, the segment ab is Delaunay edge if and only if there is an empty circle passing through a and b? Take any five points in plane and construct a Nearest Neighbor Graph with your own assumption. (4+2)

8. Mention the use of Minkowski sum in planning collision free path of a robot. Given a set of obstacles, write an algorithm for planning a motion of a convex polygon. (3+3)

9. What do you mean by range searching problem? How 1-dimentional range searching can be solved using balanced binary search trees? (2+4)

10. Define hybrid mesh with example. How mesh can be generated using Delauney Triangulation Approach? What is the need of mesh refinement? (2+3+1)

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Master Level / First Year/ 2nd Semester/ Science
Computer Science and Information Technology (CSc. 562)
(Computational Geometry)

Full Marks: 45
Pass Marks: 22.5
Time: 2 hours.

Candidates are required to give their answers in their own words as for as practicable.
The figures in the margin indicate full marks.

Group A

Attempt any two questions. (10x2=20)

1. How can you argue that the lower bound in solving convex hull problems in O(nlogn)? Given a hexagon in 2D, how can you compute its convex hull? Compare and contrast quickhull approach and the divide and conquer approach for finding convex hull? Which one you think is better? Give proper justification to your answer. (2+2+6)

2. How can you interpret Voronio diagrams in term of Half-planes? What is empty circle problem? Given a point set of sites, how Voronoi diagram can be constructed for those point sites using the empty circle test. Illustrate with an example. (2.5+2.5+5)

3. What do you mean by interior cusps? How interior cusps create non-monotonicity in a polygon? How monotone polygons can be triangulated? (2.5+2.5+5)

Group B

Attempt All questions. (5x5=25)

4. Define the geometric object point. Write an algorithm to test co-linearity of points. Perform the complexity analysis of your algorithm. (1+3+1)

5. Define quad-mesh. How topology decomposition approach differs from geometric decomposition approach for mesh generation. (1+4)

6. What can you say that motion planning is kind of decision problem? Write a generic algorithm for moving a Robot which may be either disc or polygon. (1+4)

7. What do you mean by non-orthogonal range search? How kd-trees are used in 2D-range searching? Illustrate with an example. (2+3)

8. What do you mean by art gallery problem? Without relying on Fisk's proof how can you determine the number of guards required are for an art gallery having rectilinear geometric polygonal structure? What will be the number of guards? (1+3+1)

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Master Level / First Year/ IInd Semester/ Science
Computer Science and Information Technology (CSc. 557)
(System Programming)
OLD COURSE

Full Marks: 60
Pass Marks: 30
Time: 3 hours.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all questions.

1. Write brief answers of following questions. (3x5=15)
   a. How many bits are needed to represent memory address of SIC and SIC/XE machines and what is the maximum memory size supported by these machines?
   b. Calculate target address for object codes 031600 & 0316030. Assume (B) = 6000, (PC) = 3000, and (X) = 90
   c. What are two common uses of EQU assembler directive? Describe with suitable examples.
   d. When it is better to use relocation bit mask rather than modification card and why?
   e. What kind of source program errors would be detected during lexical analysis?

2. Translate (by hand) the following assembly program to SIC/XE object code. Also show all data structures. (10)

Gauss	START	1000
First	LDT	'#9
	LDX	#0
Mchar	LDCH	S1,x
	STCH	S2,x
	TIXR	T
	JLT	Mchar
S1	BYTE	C'CDCSIT,TU"
S2	RESB	9
	END	First

3. Consider following macro definition. Show expanded macro for the macro invocation "STRGR Data1,Data2 1" and also all data structures created in pass1 and pass2 of macroprocessor (5)

STRG	MACRO	&a1, &a2, &c
	STA	&a1
	IF	(&c EQ 1)
	STB	&a2
	ELSE	
	STX	&a3
	ENDIF	
	MEND	

4. Consider the following BNF grammar, show operator precedence parsing for the statement "s=a*b+5" in systematic fashion. Assume that id must start from character always and value can be any integer constants. (5)

5. Consider following assembly program written for SIC/XE machine architecture and perform following with this: (25)
   a. Generate LOC column and also show all data structures created in pass1. (4)
   b. Generate object code column for the program. (7)
   c. Create Object code file. (4)
   d. Load object code files into memory and show linking process along with data structures used by linking loader. Assume that programs are loaded from memory location 2000 contiguously. (10)

Main	START	1000
	EXTDEF	Five, Three
	EXTREF	Sum
Begin	LDA	#5
	STA	Five
	LDA	=X'03'
	STA	Three
	+JSUB	Add
Five	RESW	1
Three	RESW	1
	END	Begin
Add	CSECT	
	EXTDEF	Sum
	EXTREE	Five, Three
	+LDA	Five
	+ADD	Three
	STA	Sum
	RSUB	
Sum	RESW	1
	END	

Assume following mnemonic codes: {LDA=00, LDB=04, ADD=18, MUL=20, LDS=6C DIVR=9C, STA=0C, JSUB=48, RSUB=4C}

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Master Level / First Year/ 2nd Semester/ Science
Computer Science and Information Technology (CSc. 565)
(Systems Programming)

Full Marks: 45
Pass Marks: 22.5
Time: 2 hours.

Candidates are required to give their answers in their own words as for as practicable.
The figures in the margin indicate full marks.

Group A

Attempt any two questions. (10x2=20)

1. Consider following assembly program written for SIC/XE machine architecture and provide solutions as indicated in following questions:
   a) Generate LOC column {10}
   b) Generate object code column for the program {3}
   {7}

Main	START	0
	EXTDEF	A,B
	EXTREF	Res
Begin	LDA	#Five
	STA	A
	LDA	=X'03'
	STA	B
	+JSUB	Subtract
	+LDA	Res
Five	WORD	5
A	RESW	1
B	RESW	1
	END	First

Subtract	START	0
	EXTDEF	Res
	EXTREF	A,B
	+LDA	A
	+SUB	B
	STA	Res
	RSUB	
Res	RESW	1
	END	

Assume following mnemonic codes: {LDA=00, SUB=1C, STA=0C, JSUB=48, RSUB=4C}

2. For the assembly language program given in question number 1, provide solutions as indicated in following questions:
   a) Create Object code file. {10}
   b) Load object code files into memory and show linking process along with data structures used by linking loader. Assume that programs are loaded from memory location 1000 contiguously {5}
   {5}

3. Write brief answer of following questions. {4x2.5=10}
   a) When relocation bit mask is appropriate to use? Explain briefly.
   b) What is macro time variable? How macro processor manages value of macro time variable?
   c) Differentiate between RESW and WORD directive with suitable example.
   d) What are control sections? Write down its importance is writing assembly language programs.

Group B

Attempt All Questions. {5x5=25}

4. Consider the macro definition given below and show macro expansion for the macro call statement "RDWR 0,1 Show all data structures used by macro processor clearly {5}

RDWR	MACRO	&IN, &OUT
	IF	&IN EQ 0
$WL	TD	OD
	JEQ	$WL
	LDCH	C
	WD	OD
	Else	
$RL	TD	ID
	JEQ	$RL
	RD	ID
	STCH	C
	MEND	

5. Write down interpretation for each of the following three sequences of statements, where LEN and ONE are program labels. {5}

```
LDA     LEN
SUB     #1
```

```
LDA     LEN-1
```

```
LDA     LEN-ONE
```

6. Calculate addressing modes and target address is each of the following Instructions. Assume that b=4000 PC=3000 and x=50. {5}
   a) *034347*
   b) *03A560*

7. Consider the following BNF grammar, devise token coding scheme for this, and then design finite automata to recognize tokens. Explain any assumptions made in designing automata. Assume that id must start from character always and value can be any integer constants. {5}

   <exp> → <exp><opr><exp>|id|val
   <opr>→ + | - | * | /

8. Write short notes on
   a) SIC and SIC/XE Instructions
   b) Absolute loader