Islamic University of Technology

Organisation of Islamic Cooperation (OIC)

Department of Computer Science and Engineering (CSE)

ONLINE EXAMINATION **WINTER SEMESTER, 2019-2020**

Duration: 45 Minutes **Full Marks: 30**

CSE 4307: Database Management Systems

This is an open book exam. You are allowed to surf the net but not allowed to talk or communicate with any human person. 10 Minutes time is allocated for processing and uploading your file. After the exam is over, scan and convert to a single pdf to upload in the classroom. Figures in the right margin indicate marks.

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1. Consider the following entities for a typical result processing system (Note: pk and fk stand for primary key and foreign key respectively:

Students
SID (pk)
Name
Address
Dept
Prog

Courses
CID (pk)
Name
Credit

Grades
SID (fk)
CID (fk)
LetterGrade

Here only allowable values for Dept attribute are CSE, EEE, MPE, CEE. Valid values for Prog attribute are Undergrad and Graduate. Notice Grades entity has no primary key (think on it in the next DDL question).

(a) Create the DDL for the above description. *[5]*

(b) Write a function in PL/SQL as follows: *[10]*

Input: Student ID

Output: *CGPA (numeric value)*

Algorithm: $CGPA = \frac{\sum Ci \times \sum Ni}{\sum Ci}$

where N_i can be obtained from the following mapping:

LetterGrade	Value (Ni)
A+	4
A	3.5
B	3
C	2
D	1.5
F	0

(Note: You can use decode() to extract value from the letter grade)

(c) Write a java program to show the results of CSE Department of undergrad program in the following format: [08]

ID	Name	Result
103	a	3.6
107	d	3.7

Note:Write only the relevant part in java, assume the database connection is already made.

(d) Write a **single SQL** to show a combined list of top 3 students Name and CGPA and bottom 2 students Name and CGPA (in terms of CGPA). [07]

(Note: You can use Rank() in this regard)

August 19, Winter, 2020

Islamic University of Technology (IUT)
Organisation of Islamic Cooperation (OIC)
Department of Computer Science and Engineering (CSE)
Semester Final Examination (Online)

CSE 4303: Data Structures

Duration: 1 Hour 30 Minutes + 10-15 minutes for submission

Full Marks: 75

Instructions:

- Write your Name, Student-ID and Course Code on the top of the first page. Maintain a serial number on the Top-right corner of each page.
- Answer all the questions. Figures in the right margin indicate marks.
- Sit in proper position and maintain the environment as per the Guidelines.
- No examinee is allowed to scan the file unless 1 hour 30 minutes is finished.
- *For any circumstances, follow the instructions of the invigilator.*

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1 The following set of numbers represent a Max Heap. 5

A = {15,13,9,5,12,8,7,4,0,6,2,1}

Perform the operation 'Heap_Extract_Max(A)' once.

2 Why is the process of building a Max heap from an arbitrary set of numbers designed in 'Bottom-up' approach? 5

3 Suppose an AVL Tree is used to implement a Min Priority Queue. What will be the complexity of the following operations: 3

a) push(x)
b) pop()
c) minimum()

4 Let T be a Binary Search Tree whose keys are distinct. Let x be a leaf node, and y be its parent. Justify that $y.key$ is either the smallest key in T larger that $x.key$ or the largest key in T smaller than $x.key$. 7

5 Build a Segment Tree using the following set of numbers for finding the Maximum value amongst a given range: 10+5

{10,5,7,-2,8,14,3,0,1,-12}

Show the detailed steps of recursion along with the step by step development of the Segment Tree.
Finally, show the detailed steps for finding the Maximum value for the range (3...7).

6 A Hash function is defined as **'h(x)=x mod 10'** A set of number is given as follows: 5+10

S={4371,1323,6173,4199,4344,9679,1989}

Show the resulting:

a) Separate chaining Hash Table.
b) Hash Table with a second hash function for solving collision:
$f(i)=i*hash_2(x)$ and $hash_2(x)=7-(x \bmod 7)$.

7 Implement a Dictionary using Trie data structure which will include a set of words. The dictionary allows the following features: 3×5

a) Allows Spell-checking and produces an error message if misspelt.
b) When the prefix of any word is inserted, it shows the number of words that starts with that prefix.

Write pseudocodes of the necessary functions for building the dictionary and implementing Features (a) & (b).

8 Let's assume the Dictionary mentioned in Question-7 is now stored in a Hash-Table. The Hash function is represented by, 10

$$Hash(word) \sum_{i=0}^{wordSize-1} word[wordSize-i-1] \times 37^i$$

Let's say the Hash table will is represented by an Array for size 100. Each word is mapped at a specific location using the Hash function. However, if two words are mapped to the same index, Linear Probing will be considered as the Collision Resolution method.
Design the algorithm and write necessary pseudocodes to satisfy the requirements.

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
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SEMESTER FINAL EXAMINATION **WINTER SEMESTER, 2019-2020**

DURATION: 1 Hour **FULL MARKS: 45**

Math 4341: Linear Algebra

General Instructions

- Write your **Name**, **Student-ID** and **Course Code** on the top of the first page. Maintain a **serial number** on the Top-right corner of each page.
- Answer all the questions. Figures in the right margin indicate marks.
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1 Suppose, a group of 4 students from IUT CSE'18 went for a tour. They bought a number of souvenirs from there. While packing, they found there were 4 different items. Suppose the items are named A, B, C & D. Everyone bought at least one item or more than that. Now, they tried to put this purchase information into a matrix (Purchase Matrix). So, the columns represent the number of a particular item they bought and the rows represent individual purchase information (number of items) of the students.

a. *It was found out that the items were arranged in the columns in this order- B->C->A->D. How do you put it in the correct order(alphabetical) in the matrix without directly manipulating the columns?* 5

b. The purchase details are as follows- 7

Items	Student 1	Student 2	Student 3	Student 4
A	2	0	1	1
B	0	1	0	2
C	1	0	1	0
D	0	2	0	5

Let's say, V_1=subspace generated by the first column of the purchase matrix
V_2=subspace generated by the third column of the purchase matrix
Find out V_1 & V_2(Draw). What is $V_1 \cap V_2$? Is it a vector subspace as well?

c. Mention the dimension of all four fundamental subspaces of the purchase matrix. What can be one good basis for the rowspace? 5

2 Time (in -th seconds) and number of errors done by a machine is given below:

Time (in -th second)	Number of errors
-2	1
0	2
2	4

a. Can you write these data points as a simple linear system? 2

b. Find a linear equation that fits these points by minimizing the error. 10

c. Can you predict the number of errors done by the machine on the 5th second? 3

3 The following system is given- 6

$$\left[\begin{array}{cc|c} 1 & 3 & 2 \\ 3 & h & k \end{array}\right]$$

Find out the values of ***h*** and ***k*** so that the system becomes-

a. Inconsistent. [No solution]
b. Consistent with infinitely many solutions.
c. Consistent with a unique solution.

4 Short Questions-

a. If a matrix has an eigenvalue with $\lambda=0$, what can you decide about the rank and columnspace of the matrix? Is it a matrix with full rank as column? Do the columns span the whole vectorspace? 4

b. If a matrix has two eigenvalues $\lambda_1=3$ and $\lambda_2=4$, 3

i. Find out the determinant of the matrix.
ii. Find out the sum of the diagonal elements of the matrix.

B.Sc. Engg. in CSE / SWE (3rd Semester) 21 August 2020

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
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Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION **WINTER SEMESTER, 2019-2020**

DURATION: 1 Hour **FULL MARKS: 50**

CSE 4305: Computer Organization and Architecture

General Instructions

- Write your **Name, Student-ID** and **Course Code** on the top of the first page. Maintain a **serial number** on the Top-right corner of each page.
- Answer all the questions. Figures in the right margin indicate marks.
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1 What is the difference between *micro-operation* and *micro-instruction*? Write the sequence of events (micro-operations) of ***"interrupt cycle"*** symbolically employing common processor registers with appropriate data flow diagram. 3+4 +3

2 Many processor designs include a register or set of registers, often known as the program status word (PSW) or flags, that contain status information. These flags typically contain condition codes plus other status information resulted from the immediately last operation. If the last operation was a subtraction operation between two operands, A and B containing 11110000 and 00010100 (*i.e.* A-B), what would be the value of <u>any three</u> of the following flags? 3

i. Carry
ii. Zero
iii. Overflow
iv. Sign
v. Even Parity
vi. Equal

3 Briefly describe different kinds of data hazards in any instruction pipeline system. (**Note:** Appropriate examples from each type are highly appreciable). 5

4 The Intel 8088 consists of a bus interface unit (BIU) and an execution unit (EU), which form a 2-stage pipeline. The BIU fetches instructions into a 4-byte instruction queue. The BIU also participates in address calculations, fetches operands, and writes results in memory as requested by the EU. If the bus is free and there is no outstanding requests and branch instructions, then answer the following questions: 2+3 +3

i. If the tasks done by the both units take equal time, by what factor does pipeline improve the performance of the 8088?
ii. Draw the timing diagram of instruction pipeline operation for 5 instructions.
iii. If there are 100 instructions in a program to be executed by the 8088, calculate the total time required to complete this program availing the instruction pipeline advancement.

5 In a 16-bit processor, at a certain time of the execution of instructions from main memory, following instructions are appeared (figure a): 6

Memory address	Content
200	XXMM
201	YYYY
202	WXYZ

Figure a: Contents of memory

Where XX denotes the opcode that instructs to load content to the register AC (accumulator), MM signifies the mode field, YYYY contains the decimal value 500 and WXYZ indicates the next instruction. For a specific mode, register R1 might be used containing the value 400. Assume that location 399 contains 999, location 400 contains 1000 and onwards accordingly. Determine the **effective address** and the **operand** to be loaded for <u>any two</u> of the following address modes represented by MM:

i. Direct
ii. Indirect
iii. PC Relative
iv. Register
v. Register Indirect

6 Convert the following high-level language statement to corresponding machine language program using one-address instruction format: 4

$$Y = (A\ X\ B) + (C\ X\ D) + E$$

7 Briefly describe the operation of the TLB and Cache to fetch any appropriate page in virtual memory system following the depiction given in figure b: 4

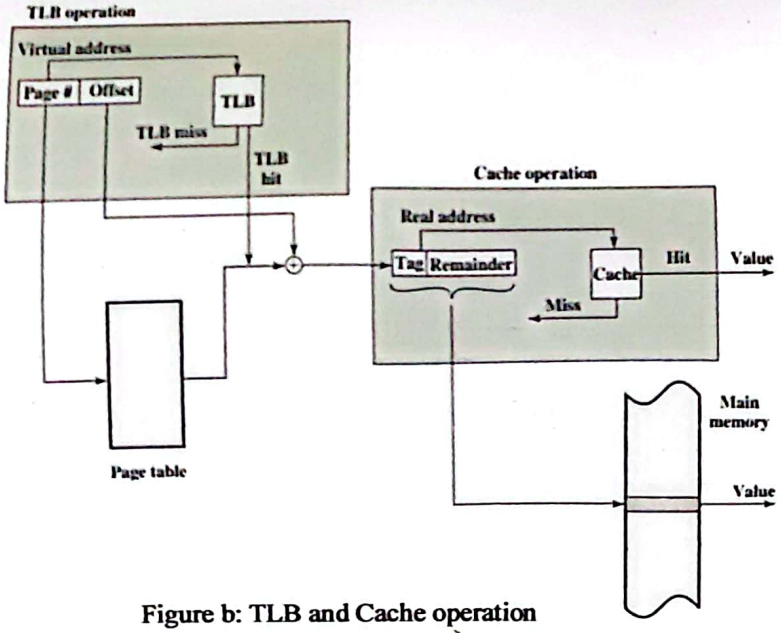

Figure b: TLB and Cache operation

8 What are the design issues to implement an interrupt driven I/O if there are multiple I/O devices? Mention the name of the appropriate approaches to overcome those issues. 5

9 Consider a magnetic disk drive with 10 surfaces, 600 tracks per surface, and 72 sectors per track. Sector size is 512 B. The average seek time is 10 ms, the track-to-track access time is 1.5 ms, and the drive rotates at 3600 rpm. Successive tracks in a cylinder can be read without head movement. 5

i. What is the disk capacity?

ii. What is the average access time? Assume this file is stored in successive sectors and tracks of successive cylinders start at sector 0, track 0 of cylinder ***i***.

iii. Estimate the time required to transfer a 5-MB file.