<h1 style="text-align:center">Intro to Databases – Flipped Classroom TWO</h1>

<h2 style="text-align:center">B+ Trees, Hashing and Relational Algebra</h2>

General Instructions:

- You must have watched all the videos for Week 3 and Week 4, you must have completed the review exercises and completed Quiz 2 BEFORE doing the "flipped classroom" so that you are fully prepared to work on the exercises with your group.
- In your Owl group of students, TOGETHER as a group, discuss and complete the questions below on the paper.
- You will be given approximately 40 minutes to complete the questions (or as much time as it appears to be taking the majority of the groups to complete the questions).
- Once the 40 minutes are up, you will swap your paper with another group.
- We will then take up the questions together and you will write a score at the top of the paper and sign your group number as the markers and have one of your members sign the paper as the marker.
- Pass the marked sheet back to the original group
- Take your marked exercises and have one member in your take a picture with his/her phone of each page. Make sure that for the first page, the group mark and marking groups signature is clear in the photo
- Have one group member upload and submit the images to owl for the flipped classroom ONE assignment AFTER IT WAS MARKED. This allows your group to use the flipped classrooms work for studying.
- The goal is for your group to learn from each other, so it is fine, actually encourage, to brainstorm and discuss and problem solve! Feel free to surf the internet or watch the course videos again to figure out your answers.

Marking Instructions:

- The flipped classrooms are worth 2% each.
- Every group member who shows up to class and stays till the end will get 1% automatically.
- The other 1% is based on what you get on the questions below, so if you get 32 out of 40 of the questions below correct, your group will get 0.8 % for this mark.
- The 2 values are then added together to get your flipped classroom mark. Thus, in the example above, you would get 1.8 % for this flipped classroom
- When you are marking the other group's paper, make sure you write the mark clearly in the box given AND that you write your group number (as the marking group) and have one of your group members sign and print his/her name as proof of marking.
- Each question is worth 1 or 2 marks but has several parts, if the group got MOST of the question right, give them the full mark, if they got more than 50% wrong, give them half marks. Add the marks together at the end and give them a score out of 1 rounded to 1 digit. (e.g. 0.7 or 0.8 or 1.0)
- **DON'T BE TOO EVIL WHILE MARKING, the goal is to understand the concepts better while learning together, not get everything perfect (but if a group everything wrong, don't give them perfect-try to find a nice balance!)**
- Pass the marked sheet back to the group you were marking.

Objectives:

- To practice inserting in Hash Tables and B+ trees
- To gain experience reading and writing Relational Algebra Expressions
- To learn collaboratively how to problem solve

YOUR GROUP NUMBER: _____

Group Member Name (PRINT)	Present Today (Circle One)	
1	YES	NO
2	YES	NO
3	YES	NO

THIS AREA IS ONLY TO BE FILLED IN BY THE MARKING GROUP

Marking Group Number:	
Name of one of the marking group members (Printed)	
Signature of that group member	
SCORE OUT OF 1 (Total for this sheet is 40, so just divide by 40 and round to 1 decimal)	

QUESTION 1 (10 Marks)

Part 1 (2 Marks – Hashing) : Hash the values: 222, 555, 666, 777, 1000, 100, 12, 155 until you get a collision. Do the hashing in the order the numbers are given.

Part A: First hash into 2 buckets of that can hold 3 value(keys). The value **12**_____ caused the collision (fill in the blank AND show your buckets below):

Part B: Hash the same numbers into 6 buckets where each bucket can hold 2 values. The value **12**_____ caused the collision (fill in the blank AND show your buckets below):

Part 2 (3 Marks – B+ Tree Insertion): Put the following values into a B+-Tree in the order given. Try to show each step . The tree should have order P=3 and Pleaf=2:

The values are: **6, 9, 12, 3, 7, 1, 5, 8**

Part 3 (3 Marks – One more B+ Tree Insertion): Put the following values into a B+-Tree in the order given. Try to show each step. The tree should have order P=3 and Pleaf=2:

The values are: **23, 65, 37, 60, 46, 92, 48, 71, 56, 59**

Part 4 (2 Marks – Last B+ Tree Insertion): Put the following values into a B+-Tree in the order given. This time see if you can figure out what happens when the tree has order P=4 and Pleaf=3. Each node will look [ ][ ][ ][ ] and you push up either the second value or third value (it doesn't matter which you choose as long as you are consistent and once you have decide on the second or third, you stick with that decision). The values are: **23, 65, 37, 60, 46, 92, 48, 71, 56, 59**

QUESTION 2 (20 Mark)

Use the following tables for all of question 2:

Table Name	Table Layout
EMPLOYEE	FName | Minit | LName | SSN | BDate | Address | Sex | Salary | SuperSSN* | DNO*
DEPARTMENT	DName | DNumber | MGRSSN * | MGRStartDate
DEPTLOCS	DNumber * | DLocation
WORKSON	ESSN * | PNO * | Hours
PROJECT	PName | PNumber | PLocation | DNum*
DEPENDENT	ESSN* | DependentName | Sex | BDate | Relationship

Write the following queries as a relational algebra statement (you can break it into sub steps if you want):

1. (2 Marks) Get the first and last name of all the employees.

2. (2 Marks) Get all the employee data for employees with the first name of "Homer"

3. (2 Marks) Get the first and last names of all employees who work for department number 5

Table Name	Table Layout									
EMPLOYEE	FName	Minit	LName	SSN	BDate	Address	Sex	Salary	SuperSSN*	DNO*
DEPARTMENT	DName	DNumber	MGRSSN *	MGRStartDate						
DEPTLOCS	DNumber *	DLocation								
WORKSON	ESSN *	PNO *	Hours							
PROJECT	PName	PNumber	PLocation	DNum*						
DEPENDENT	ESSN*	DependentName	Sex	BDate	Relationship					

4. (2 Marks) Get the first and last names of all employees who work for the "Research" Department

5. (3 Marks) For every project located in "Stafford", list the project number, the controlling department number, and the department manager's last name, address and birthdate.

6. (3 Marks) Find the names of employees who work on ALL the projects controlled by department number 5

Table Name	Table Layout									
EMPLOYEE	FName	Minit	LName	SSN	BDate	Address	Sex	Salary	SuperSSN*	DNO*
DEPARTMENT	DName	DNumber	MGRSSN *	MGRStartDate						
DEPTLOCS	DNumber *	DLocation								
WORKSON	ESSN *	PNO *	Hours							
PROJECT	PName	PNumber	PLocation	DNum*						
DEPENDENT	ESSN*	DependentName	Sex	BDate	Relationship					

7. (4 Marks) Make a list of project numbers for projects that involve an employee whose last name is "Smith", either as a worker or as a manager of the department, that controls the project.

8. (2 Marks) List the first and last names of employees who have no dependents:

QUESTION 3: (10 Marks (2 Marks Each))

Given the following tables:

Table AA

a	b	c
1	2	4
2	3	4
3	2	5

Table BB

d	e
2	6
3	5

Table CC

a	d	c
1	2	4
1	6	4
2	2	9

Draw the table that would be returned by the following relational algebra expressions:

1. **TEMP1 ← AA⋈ $_{b=d}$ BB**

2. **TEMP2 ← BB ⋈ CC**

3. **TEMP3 ← AA ⋈ CC**

4. **TEMP4 ← AA ⋈ $_{c > d}$ CC**

5. **TEMP5 ← AA ⋈ CC ⋈ BB**