SE305 Database System Technology
Assignment 1
Due: Sept 18, 2018

1. Explain the difference between physical and logical data independence.

2. List seven programming languages that are procedural and two that are non-procedural. Which group is easier to learn and use? Explain your answer.

3. Consider the following three relations

A	B
1	a
2	b
3	c
1	b
2	c
2	a

R

B	C	D
a	1	x
b	2	y
b	3	x
c	4	y

S

D	E
x	1
y	2
z	3

T

For each of the following relational expressions, compute the result on the above relations and submit only the final answer. For example, for query: $\pi_{B,D}(S)$, the result should be entered as: {(a, x), (b, y), (b, x), (c, y)}.

(a) $\pi_{A,D}(R \times S)$

(b) $\pi_{A,D}(R \bowtie S)$

(c) $\pi_E(T) - \pi_E(S \bowtie T)$

(d) $\sigma_{E>1}(S \text{ right natural outer join } T)$

(e) $\pi_C(S) - \pi_{S.C}(\sigma_{S.C<S2.C}(S \times \rho_{S2}(S)))$

4. What is the result of the following expressions under the multi-set/bag semantics?

   (a) $\{a, b, b, c, c\} \cup \{a, a, a, b\} =?$

   (b) $\{a, b, b, c, c\} \cap \{a, a, a, b\} =?$

   (c) $\{a, b, b, c, c\} - \{a, a, a, b\} =?$

   (d) $\{a, b\} \times \{c, c\} =?$

5. Consider the following expressions, which use the result of a relational algebra operation as the input to another operation. For each expression, explain in words what the expression does.

   a. $\sigma_{year \geq 2009}(takes) \bowtie student$

   b. $\sigma_{year \geq 2009}(takes \bowtie student)$

   c. $\Pi_{ID, name, course\_id}(student \bowtie takes)$

6. Consider a relation: roommates(person1-ssn, person2-ssn, address, start-date, end-date, landlord-id). Interpretation being: person1 and person2 were renters at address during the period start-date to end-date, and their landlord was given by landlord-id. Assume a person can only be a renter at one house at any specific time (i.e., a person cannot be residing at two different addresses at the same time). Two people may be roommates at different times in different houses or in the same house; the landlord may change at any time (i.e., the house may be sold) without the renters moving out.

   (a) Is {person1-ssn, person2-ssn, start-date} a candidate key for this relation? Briefly explain your reasoning.

   (b) Is {person1-ssn, person2-ssn, landlord-id} a candidate key for this relation? Briefly explain your reasoning.

7. Consider the relation database of figure below, where the primary keys are underlined. Given an expression in the relational algebra to express each of the following queries.

employee (<u>employee_name</u>, street,city)

works (<u>employee_name</u>, company_name,salary)

company (<u>company_name</u>, city)

manages (<u>employee_name</u>, manager_name)

a. Find the names of all employees who live in the same city and on the same street as do their managers.

b. Find the names of all employees in this database who do not work for First Bank Corporation and earn more than $10,000.

c. Find the names of all employees who earn more than every employee of small Bank Corporation.