

## COP 4710 – Database Systems – Spring 2004

### Homework #2 – 150 points

Due: In class **Monday February 23<sup>rd</sup>** . NO LATE ASSIGNMENTS ACCEPTED

Answer each of the following questions completely. Make sure that your answers are neatly written and very readable. Points will be deducted if your assignment is not presented in a neat format. For example, don't turn it in on notebook paper torn out of a spiral notebook.

#### Problem #1 (10 points each)

Form relational algebra expressions that will produce the correct results for each of the following queries: Use only the five fundamental operators in your expressions.

Use this sample database:

|     |                                            |
|-----|--------------------------------------------|
| s   | ( <u>s#</u> , name, rank, city, workers)   |
| p   | ( <u>p#</u> , name, color, weight, city)   |
| j   | ( <u>j#</u> , name, workers, city)         |
| spj | ( <u>s#</u> , <u>p#</u> , <u>j#</u> , qty) |

where: in s: rank is a numeric field, and workers is the number of employees of that supplier.

in p: city is the city in which the part is built.

in j: workers is the number of workers on that job.

1. List the names of all the suppliers who supply part P2 to any job.
2. List the names of those cities in which there is a job located that employs more than 200 workers.
3. List the supplier names for those suppliers who supply at least one red part.
4. List the names of those suppliers who do not supply part number P2.

#### Problem #2 (10 points each)

Using the same database as for Problem #1, produce a relational algebra expression using any of the operators that we have discussed; for the following queries.

1. List the names of all those suppliers who ship every green part to every job in Madrid.
2. List the supplier names for those suppliers who supply at least one red part.

3. List the names of those suppliers who do not supply part number P2.

**Problem #3 (5 points each)**

Given the relation instances shown below, produce the result relation which is generated by each of the following “queries”. If the relational algebra expression is invalid, indicate why.

Let the schemas be  $R = (A, B, C)$ ,  $S = (B, C, D)$ , and  $T = (A, E, F)$

| A | B | C |
|---|---|---|
| a | h | a |
| b | b | b |
| b | j | k |
| c | g | d |
| a | a | a |
| b | g | a |
| c | j | g |
| b | g | k |
| c | c | c |
| b | d | a |

$r(R)$

| B | C | D |
|---|---|---|
| a | d | m |
| b | d | a |
| c | g | d |
| a | g | a |
| b | j | k |
| c | g | a |
| a | h | a |
| b | g | a |
| c | j | f |

$s(S)$

| A | E | F |
|---|---|---|
| 2 | a | a |
| 5 | g | r |
| 8 | b | r |
| 7 | p | r |
| 6 | k | b |
| 4 | h | b |
| 3 | v | a |

$t(T)$

(a)  $\pi_{(r.A)}(\sigma_{(r.B=s.B)}([\sigma_{(A=a)}(r)] \times [\sigma_{(C=g)}(s)]))$

(b)  $r \cup t$

(c)  $r - (r - s)$

(d)  $\pi_{(C)}(s) \times \pi_{(F)}(t)$

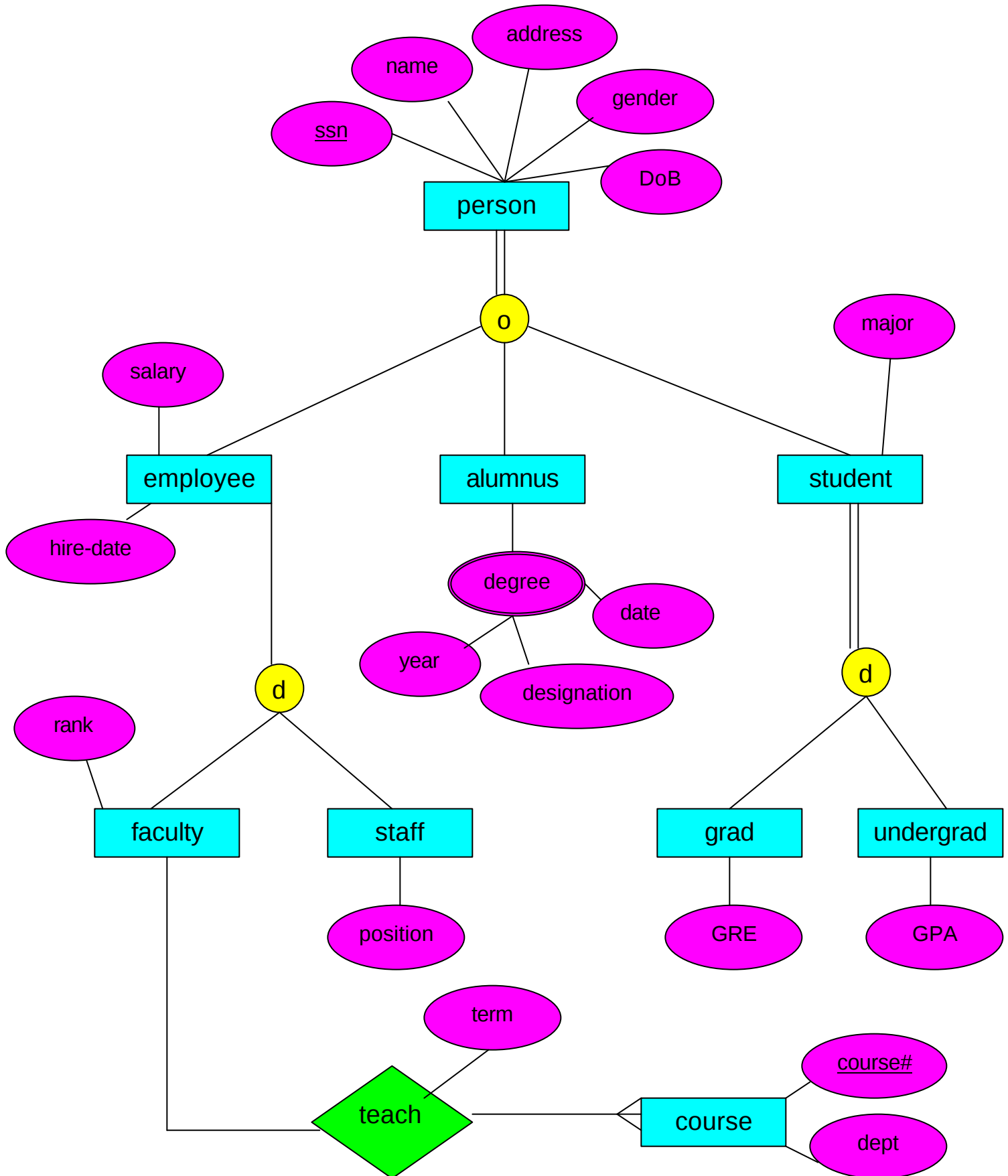
(e)  $(\pi_{(A)}(r)) \cup (\pi_{(A)}(t))$

(f)  $(\pi_{(B,C)}(r)) - (\pi_{(B,C)}(s))$

(g)  $(\pi_{(A,B)}(\sigma_{(C=a)}(r))) \cup (\pi_{(E,F)}(\sigma_{(F=a)}(t)))$

**Problem #4 (15 points)**

Convert the following E-R diagram into a set of relations according to the conversion techniques presented in the lecture notes.



**Problem #5 (10 points each)**

For each of the following queries produce a tuple calculus expression which will correctly produce the results for the query. Use the same database as for problem #1.

1. List the names of suppliers who supply every part.
2. List the names of suppliers who do not supply part P2.
3. List the supplier numbers and supplier names for those suppliers who supply at least one red part to some job.