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INFSCI 2710 “Database Management” — More Example Exercises for Final Exam —

Exercise 1 (SQL Errors) 6 Points

Consider a database containing information about films:

- FILM(ID, TITLE, YEAR, DIRECTOR, OSCARS)
- ROLE(ID→FILM, ROLE_NAME, ACTOR_NAME)
- CRITIQUE(ID→FILM, SOURCE, GRADE, TEXT) /* Review */

Suppose we want to find films without any critique/review (a newspaper article saying whether the film was good or bad). Which of these solutions are correct, and which are incorrect? If it is incorrect, please give a very short explanation.

a)
```
SELECT ID, TITLE
FROM   FILM
WHERE  ID NOT IN(SELECT C.ID FROM CRITIQUE C)
```

☐ Correct
☐ Wrong, Reason: ______________________________

b)
```
SELECT F.ID, F.TITLE
FROM   FILM F, CRITIQUE C
WHERE  F.ID = C.ID AND C.SOURCE IS NULL
```

☐ Correct
☐ Wrong, Reason: ______________________________

c)
```
SELECT F.ID, F.TITLE
FROM   FILM F
WHERE  NOT EXISTS(SELECT * FROM CRITIQUE C)
```

☐ Correct
☐ Wrong, Reason: ____________________

Suppose that now we want to find films which were unanimously rated "A" (i.e. there is at least one review with the grade "A", and there is no review with another grade). E.g. if the film got grades AAA from three different sources, it should be printed, if it got ABA, it should not be printed. Which of these solutions are correct, and which are incorrect?

d)
```
SELECT F.ID, F.TITLE
FROM   FILM F
WHERE  F.ID NOT IN (SELECT C.ID FROM CRITIQUE C
                    WHERE GRADE <> 'A')
```

☐ Correct
☐ Wrong, Reason: ____________________

e)
```
SELECT F.ID, F.TITLE
FROM   FILM F, CRITIQUE C
WHERE  F.ID = C.ID
AND    C.GRADE = 'A'
```

☐ Correct
☐ Wrong, Reason: ____________________

f)
```
SELECT F.ID, F.TITLE
FROM   FILM F, CRITIQUE C
WHERE  F.ID = C.ID AND C.GRADE = 'A'
AND    NOT EXISTS(SELECT * FROM CRITIQUE X
                  WHERE X.ID = F.ID AND X.GRADE <> 'A')
```

☐ Correct
☐ Wrong, Reason: ____________________

Exercise 2 (FDs, BCNF) 7 Points

Consider the following relation used for storing the result of multiple choice tests like this one:

MULTIPLE_CHOICE_TEST			
STUDENT	QUESTION	ANSWER	CORRECT
John Smith	a	2	Y
John Smith	b	2	N
John Smith	c	3	N
Maria Brown	a	2	Y
Maria Brown	b	3	N
Maria Brown	c	1	Y

We assume that the name uniquely identifies a person. Questions are identified by a letter (`a`, `b`, `c`). Possible answers (options among which the student must choose) are identified by the question and a number (first checkbox, second, etc.). E.g. `2` may be the right answer for question `a`, but the choice `2` for question `b` may be wrong (note that this only an example, it does not necessarily correspond to this test). For every question, only one answer may be selected, and only one answer is correct.

Assume that the following function dependencies hold:

- `STUDENT, QUESTION` → `ANSWER`
- `QUESTION, ANSWER` → `CORRECT`

a) What does the functional dependency “`QUESTION, ANSWER` → `CORRECT`” mean? Please check the right explanation (only one is correct):

- ☐ Every question has only one correct answer.
- ☐ The correctness of an answer to a question is independent from the student.
- ☐ It is not possible that the same answer is correct for two different questions.

b) We want to make sure that not more than one answer to a query can be correct. Would the FD “`QUESTION, CORRECT` → `ANSWER`” do the job?

- ☐ Yes. This is the right way to enforce the constraint.
- ☐ This FD is not even satisfied in the given table, but the table satisfies “not more than one correct answer”. The FD is too strong (although it would imply that every question has only one correct answer).
- ☐ The FD is already implied by the given FDs.

c) Can functional dependencies be determined by looking at example data?

- ☐ Yes.
- ☐ Example data can only show that functional dependencies do not hold. You cannot conclude from example data that an FD must hold in general.
- ☐ If an FD holds in an example relation, you can use it for the BCNF test. However, there might be further FDs, which do not hold in this database state, and which also have to be considered.

d) Is the FD "`STUDENT, QUESTION` → `CORRECT`" implied by the given two FDs?

- ☐ Yes.
- ☐ No.

e) What is the (minimal) key of the relation with respect to the two given FDs? (It has only one key.)

- ☐ `STUDENT, ANSWER`
- ☐ `QUESTION, ANSWER`
- ☐ `STUDENT`
- ☐ `STUDENT, QUESTION`
- ☐ `STUDENT, QUESTION, ANSWER`

f) Is the relation in BCNF?

- ☐ Yes.
- ☐ No. The FD "`STUDENT, QUESTION` → `ANSWER`" violates BCNF.
- ☐ No. The FD "`QUESTION, ANSWER` → `CORRECT`" violates BCNF.
- ☐ No. Both FDs violate the BCNF condition.

g) What would be a lossless decomposition (only one answer is correct)?

- ☐ `R1(STUDENT, ANSWER)` and `R2(QUESTION, ANSWER, CORRECT)`
- ☐ `R1(STUDENT, QUESTION)` and `R2(ANSWER, CORRECT)`
- ☐ `R1(STUDENT, QUESTION, ANSWER)` and `R2(QUESTION, ANSWER, CORRECT)`
- ☐ None of the above.