Database Management System
Assignment 2

Q1. Consider the relation schema R(A, B, C, D, E, F) wijth functional dependencies AC → B, BD → F and F → CE.

1. How many candidate keys does R have?
2. List all the candidate keys of R. If a candidate key is composite then use parenthesis
   e.g. (A, B).
3. Is R in 3NF? If yes, justify. If no, specify at least one FD which violates the definition?
4. Which FD(s) (if any) of R violates BCNF?
5. Consider the decomposition of R into R1(A, B, C), R2(C, E, F) and R3(A, D, F). Give YES/NO answers for the following:
   i. Is this decomposition lossless?
   ii. Is this decomposition dependency preserving?
   iii. Is this decomposition in BCNF (i.e. are R1, R2 and R3 all in BCNF)?

Q2. Consider the following legal instance of a relational schema *S* with attributes *ABC*:

A	B	C
α	9	T
α	16	F
β	20	F

Which of the following dependencies are *violated* by the instances of *S*?

i) $A \rightarrow B$ is violated.

ii) $B \rightarrow A$ is violated.

iii) $C \rightarrow A$ is violated.

iv) $AC \rightarrow B$ is violated.

v) $B \rightarrow AC$ is violated.

Q3. Consider the relational schema $r = \{P,Q,R,S,T,U,V\}$ and the set of functional dependencies FD:

P -> Q Q-> R PS -> TRV QT -> UR S -> V

a) Which of the following is a minimum cover of the FD?

i) The given FD is a minimum cover.

ii) $\{P \rightarrow Q, Q \rightarrow R, PS \rightarrow T, QT \rightarrow UR, S \rightarrow V\}$

iii) $\{P \rightarrow Q, Q \rightarrow R, P \rightarrow T, Q \rightarrow U, S \rightarrow V\}$

iv) $\{P \rightarrow Q, Q \rightarrow R, PS \rightarrow T, QT \rightarrow U, S \rightarrow V\}$

v) none of the above - the cover is _____

(b) Which of the following functional dependencies can be deduced, from the above set of functional dependencies?

i) P ->R

ii) PS -> U

iii) QS -> U

iv) QST -> P

c) The attribute closure $\{Q\}^+$ is _____.

d) The attribute closure $\{PS\}^+$ is _____.

Q4. Consider the relation with attributes, S = {*A,B,C,D,E,F*}, Let the following functional dependencies *FD* be defined over the relation S:

$A \rightarrow D$ $A \rightarrow E$ $D \rightarrow C$ $D \rightarrow F$

a) Provide the attribute closure of {AB}.

b) Identify whether the decomposition *ABC*, *CDE*, *EFA* is lossless and dependency preserving?

c) Identify whether the decomposition *ABCE*, *ADC*, *ADEF* is lossless and dependency-preserving?

Q5. Consider the relation with attributes, S = {*A,B,C,D,E*}. Let the following functional dependencies be defined over the relation S,

$A \rightarrow BC$ $CD \rightarrow E$ $B \rightarrow D$ $E \rightarrow A$

a) Identify whether this relationship in 3NF and/or BCNF?

b) Give a BCNF decomposition of S that is lossless.

c) Is your BCNF decomposition dependency preserving?

d) Give a 3NF decomposition of S that is lossless and dependency preserving.