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Q1.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(3 Marks) Select, from the choices below, ALL functional dependencies in  $F^+$ .

- A.  $A \rightarrow A$
  - B.  $B \rightarrow BC$
  - C.  $C \rightarrow DE$
  - D.  $D \rightarrow EF$
  - E. None of the above
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Q2.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(3 Marks) Select, from the choices below, ALL trivial functional dependencies in  $F^+$ .

- A.  $A \rightarrow A$
  - B.  $B \rightarrow BC$
  - C.  $C \rightarrow DE$
  - D.  $D \rightarrow EF$
  - E. None of the above
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Q3.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(3 Marks) Select, from the choices below, ALL non-trivial functional dependencies in  $F^+$  that are NOT completely non-trivial.

- A.  $A \rightarrow A$
  - B.  $B \rightarrow BC$
  - C.  $C \rightarrow DE$
  - D.  $D \rightarrow EF$
  - E. None of the above
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Q4.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(3 Marks) Select, from the choices below, ALL completely non-trivial functional dependencies in  $F^+$ .

- A.  $A \rightarrow A$
  - B.  $B \rightarrow BC$
  - C.  $C \rightarrow DE$
  - D.  $D \rightarrow EF$
  - E. None of the above
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Q5.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(3 Marks) Select, from the choices below, ALL functional dependencies in some minimal cover of  $F$ .

- A.  $A \rightarrow A$
- B.  $B \rightarrow C$
- C.  $C \rightarrow D$
- D.  $D \rightarrow E$
- E. None of the above

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Q6.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(3 Marks) Select, from the choices below, ALL superkeys of  $R$  with respect to  $F$ .

- A. ABC
- B. BCD
- C. CDE
- D. DEF
- E. None of the above

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Q7.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(3 Marks) Select, from the choices below, ALL keys of  $R$  with respect to  $F$ .

- A. AB
- B. BC
- C. CD
- D. DE
- E. EF

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Q8.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(3 Marks) Select, from the choices below, ALL prime attributes of  $R$  with respect to  $F$ .

- A. A
- B. B
- C. C
- D. D
- E. E
- F. F

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Q9.

SampleExam\_question.txt

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(3 Marks) Given a decomposition of  $R$ :

$R_1(A,E)$

$R_2(A,B,C,D,F)$

Select, from the choices below, ALL true statements.

- A. The decomposition is a lossless-join BCNF decomposition of  $R$
- B. The functional dependency  $A \rightarrow D$  is in  $F^+$  and not preserved by the decomposition
- C. The functional dependency  $CF \rightarrow D$  is in  $F^+$  and not preserved by the decomposition
- D. The functional dependency  $AB \rightarrow D$  is in  $F_{R_2}$
- E. None of the above

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Q10.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

Questions 10-12 also use the following proof that the set of attributes  $\{ E, F \}$  is a superkey of  $R$  with respect to  $F$ . The proof uses Extended Armstrong's Axiom such that ALL the rules in Extended Armstrong's Axiom are utilized.

- (1)  $F \rightarrow CD$  [ Given ]
- (2)  $C \rightarrow AB$  [ Given ]
- (3)  $EF \rightarrow ECD$  [ \_Q11\_ ]
- (4) \_\_\_\_\_ [ Decomposition of (3) ]
- (5)  $EF \rightarrow AB$  [ Transitivity of (4) and (2) ]
- (6) \_\_\_\_\_ [ \_Q11\_ ]
- (7)  $EF \rightarrow ABCDEF$  [ Union of ( \_Q12\_, \_Q12\_, ..., \_Q12\_ ) ]

You are advised to fill the blanks in the proof before attempting the questions.

(2 Marks) Select, from the choices below, ALL functional dependencies used in the proof that can be put in place of the blanks \_Q10\_.

- A.  $EF \rightarrow A$
- B.  $EF \rightarrow B$
- C.  $EF \rightarrow C$
- D.  $EF \rightarrow D$
- E.  $EF \rightarrow E$
- F.  $EF \rightarrow F$
- G. None of the above

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Q11.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

Questions 10-12 also use the following proof that the set of attributes  $\{ E, F \}$  is

a superkey of R with respect to F. The proof uses Extended Armstrong's Axiom such that ALL the rules in Extended Armstrong's Axiom are utilized.

- (1)  $F \rightarrow CD$  [ Given ]
- (2)  $C \rightarrow AB$  [ Given ]
- (3)  $EF \rightarrow ECD$  [ \_Q11\_ ]
- (4) \_\_\_\_\_ [ Decomposition of (3) ]
- (5)  $EF \rightarrow AB$  [ Transitivity of (4) and (2) ]
- (6) \_\_\_\_\_ [ \_Q11\_ ]
- (7)  $EF \rightarrow ABCDEF$  [ Union of ( \_Q12\_, \_Q12\_, ..., \_Q12\_ ) ]

You are advised to fill the blanks in the proof before attempting the questions.

(2 Marks) Select, from the choices below, ALL rules used in the proof that can be put in place of the blanks \_Q11\_.

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Q12.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

Questions 10-12 also use the following proof that the set of attributes  $\{ E, F \}$  is a superkey of R with respect to F. The proof uses Extended Armstrong's Axiom such that ALL the rules in Extended Armstrong's Axiom are utilized.

- (1)  $F \rightarrow CD$  [ Given ]
- (2)  $C \rightarrow AB$  [ Given ]
- (3)  $EF \rightarrow ECD$  [ \_Q11\_ ]
- (4) \_\_\_\_\_ [ Decomposition of (3) ]
- (5)  $EF \rightarrow AB$  [ Transitivity of (4) and (2) ]
- (6) \_\_\_\_\_ [ \_Q11\_ ]
- (7)  $EF \rightarrow ABCDEF$  [ Union of ( \_Q12\_, \_Q12\_, ..., \_Q12\_ ) ]

You are advised to fill the blanks in the proof before attempting the questions.

(1 Marks) Select, from the choices below, ALL line numbers that can be put in place of the blanks \_Q12\_. Select the MINIMAL number of combinations.

- A. (1)
- B. (2)
- C. (3)
- D. (4)
- E. (5)
- F. (6)

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Q13.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(5 marks) Give one possible minimal cover of F.

SampleExam\_question.txt

If a functional dependency  $AB \rightarrow CD$  is in your answer, then you should write  $AB \rightarrow CD$

- You should use dash (-) and greater than symbol (>) instead of arrow to form the arrow ( $\rightarrow$ ) with a space before and after
- There should be NO space or other symbols between attributes
- The attributes on each LHS and RHS should be arranged in ascending order
- The attributes should be in uppercase
- The attributes should NOT be enclosed in bracket

If you have multiple functional dependencies such as  $A \rightarrow B$  and  $C \rightarrow D$  in your answer, you should write  $A \rightarrow B; C \rightarrow D$  where each functional dependency follows the above mentioned requirement

- The functional dependency must be separated by a semi-colon (;)
- There should be a space between the functional dependencies after the semi-colon

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Q13.

Questions 1-14 use the schema  $R(A,B,C,D,E,F)$  and set of functional dependencies  $F = \{ A \rightarrow D, C \rightarrow AB, B \rightarrow AC, A \rightarrow BF, F \rightarrow CD \}$ .

(5 marks) Using the minimal cover computed from Q13, give one possible lossless-join, dependency-preserving, 3NF decomposition of  $R$  with respect to  $F$ .

If  $R_1$  is a relation in your answer for the decomposition with attributes  $\{ B, C, D \}$ , then you should write  $R_1(BCD)$

- There should be NO space or other symbols between attributes
- The attributes should be arranged in ascending order
- The attributes should be in uppercase
- The attributes should be enclosed in bracket
- The name of the relation should be before the bracket, without space

If you have multiple relations such as  $R_1$  and  $R_2$  in your answer, you should write  $R_1(...); R_2(...)$  where ... is the set of attributes for each relation following the above mentioned requirement

- The relations must be separated by a semi-colon (;)
  - There should be a space between the relations after the semi-colon
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