# United International University
## Department of Computer Science and Engineering

CSI 221: Database Management Systems  Final : Fall 2020

Total Marks: 25  Time: 1 hour 15 minutes

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*Answer all the questions. Numbers to the right of the questions denote their marks.*

1. Consider the following scenario:
   There are many cricket clubs in Bangladesh. A club has an id and is described by the club's name and home ground. Each player has a unique player id, name, address and preferred jersey number. A player can play under a club on contract. A contract has an id, signed date, contract start date, contract end date and paying amount. A club has two types of members, official members and non-official members. A member (both official and non-official members) has a member id, name, rank and nationality. An official member has a managerial position in a club, but non-official members do not have any managerial position. Non official members have a job title, but official members do not have any job title. A member cannot be both an official and non-official member at the same time. Also one can only be a member of a single club only. Clubs also have an owner. An owner has a NID no., name, nationality and address. A club can have a single owner, but an owner can own many clubs. A club also records the date when the owner bought the club.

   (a) Design an ER Diagram for the scenario that satisfies all the given requirements. [4]

   (b) Find out the relational schemas for the scenario. [3]

2. (a) Consider the given Relation *R1* and the set of Functional Dependencies *F1*.
   *R1 = (A, B, C, D, E, F, G, H)* and *F1 = {A → D, A → CE, F → GH, CB → AH, E → AG}*
   Find Closures for the following attribute sets: [3]
   i. EG
   ii. DA
   iii. F

   (b) Consider the given Relation *R2* and the set of Functional Dependencies *F2*.
   *R2 = (A, B, C, D, E, F)* and *F2={ABC → DE, BC→ A, DE → BF, CE→ BE}*
   i. Determine the *Canonical Cover* of the given Relation *R2*. [4]
   ii. Determine a *candidate key* of the relation *R2*. [3]

3. (a) Draw the *precedence graph* from the given schedule. Is the schedule *serializable*? If yes, then produce an equivalent serial schedule and also state if other equivalent serial schedules are possible. [4]

| T1 | T2 | T3 | T4 | T5 |
|---|---|---|---|---|
| Read (X) | - | - | - | - |
| Write(X) | - | - | - | - |
| - | - | - | Read(Z) | - |
| - | - | - | - | Read(Y) |
| - | - | Read(Z) | - | - |
| - | - | - | - | Write(Y) |
| - | Read(Y) | - | - | - |
| - | - | - | - | Write(V) |
| - | - | - | Write(Z) | - |
| - | Write(Y) | - | - | - |
| - | - | - | Read(V) | - |
| - | - | Read(Y) | - | - |
| - | - | - | Read(X) | - |
| - | - | Write(Y) | - | - |
| Read(Y) | - | - | - | - |
| Write(Y) | - | - | - | - |

   (b) Construct a $B^+$*-tree* for the following set of key values where *m=4 (order)*: [4]
   *24, 13, 15, 7, 9, 12, 14, 6, 8, 17*