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**DUBLIN INSTITUTE OF TECHNOLOGY**

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**BSc. (Honours) Degree in Computer Science**

**BSc. (Honours) Degree in Computer Science (International)**

**Year 2**

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**WINTER EXAMINATIONS 2015/2016**

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**DATABASES I [CMPU2007]**

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Dr. D. Lillis

Mr. K. Foley

Friday 19th January 1.00 P.M. – 3.00 P.M.

SOLUTIONS

**Answer ALL questions.**

There is a syntax table on the last page to assist you.

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| **Case Study #1 – Footie AFC**  The following relational schema and interpretation will be used in subsequent questions:  **clubMember**(mID, fName, surname, email)  **Manager**(mgrID, mgrName, mgrEmail)  **team**(tNo, tName, mgrID)  **teamMember (**tNo, mID)  **practiceSlots**(pSlotNo, parkLocation, weekday, start\_time, end\_time)  **practiceBooking**(pSlotNo, tNo)  Note: underlined attributes indicate how each instance of a relation is identified.  Footie AFC is a football club based in Walkinstown, Dublin. The club has access to a number of playing pitches in Tymon Park.  Details of club members are stored in the clubMember table. Stored for each club member is a unique number (mID), their first name (fName) and surname (surname) and email address (email).  Details of managers are stored in the Manager table. Stored for each manager is a unique number (mgrID), their name (mgrName) and email address (mgrEmail).  Details of each team are stored in the team table. Stored for each team are its unique number (tNo), name (tName), and ID of the team manager who acts as the team manager (mgrID). Each team can only have one manager but each manager can manage many teams.  Each team has a number of members. The members for each team are stored on the teamMember table. Details stored are the number of the team (tNo) and the member ID of the member (mID). Each team can have many members. Each member can belong to only one team.  The club has a number of pitches booked in Tymon park for practice on selected days of the week and certain times on these days. Each practice slot available is stored in the practiceSlots table. Details stored are a unique number (pSlotNo), the location of the pitch in the park (parkLocation), the day of the week (weekday), the start of the timeslot it is available on that day (start\_time) and the end time of that timeslot (end\_time).  The team manager can book these slots for their teams. Details of practice bookings are stored in the practiceBooking table. Details stored are the number of the slot booked (pSlotNo) and the team number for which it is booked (tNo). Each slot can be booked by only one team but each team can book many practice slots. |

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| **1.** | **(a)** | 1. Draw a *physical* *Entity Relationship diagram (ERD)* for the case study above showing the attributes for each entity and identifying clearly primary and foreign keys.   **(14 marks)** |
| **Marking/Solution:**  **4 marks** for correct identification of entities, and placement of attributes and correct primary keys  **2 x 5 marks (10 marks)** for correct foreign keys and relationships | | |
|  |  | 1. Explain *what type of entity* practicebooking is. Explain clearly why it is necessary and what type of relationship it helps resolve when transforming from logical to physical design.   **(6 marks)** |
| **Marking/Solution:**  **3 marks** definition and explanation of weak entity (cannot be identified by its attributes alone, must use foreign key plus its own for identity)  **2 marks** for explaining why it is needed in relational database  **1 mark**  identifying many-to-many | | |

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| **1.** | **(b)** | When creating the Footie AFC database the following requirements must be adhered to :   * all identifiers for all data must be numeric capable of storing up to 6 digits; * all names and pitch locations must be alphanumeric capable of storing up to 30 characters and cannot be null; * day of the week is stored as a numeric which can only take values 1 to 7; * a manager must have an email address, team members do not need to provide one; * start\_time and end\_time must be stored as a character value and values will be inserted in the format HH:MM; * foreign key constraints must be named with the names of the tables involved and \_fk e.g. table1\_table\_2\_fk.  1. Write the SQL to *Create* all the tables required by the Footie AFC database *including all constraints required.*Explain the order in which the tables need to be created and why.   **(15 marks)** | |
| **Marking/Solution:**  **4 marks** Correctly formatted create statements with primary keys and datatypes.  **4 marks** Value constraints (names & locations not null, mgr email not null, check day of week)  **5 marks** Foreign Key constraints (team to manager, clubmember to team member, team to team member, practiceslot to practicebooking, team to practicebooking)  **2 marks** Explanation of order of creation | | | |
| Create table clubMember(  mID numeric(6) PRIMARY KEY,  fName varchar2(30) NOT NULL,  surname varchar2(30) not null,  email varchar2(30) ) ;  Create table Manager(  mgrID numeric(6) primary key,  mgrName varchar2(30) not null,  mgrEmail varchar2(30) not null); | | | Create table teamMember(  tNo numeric(6),  constraint tm\_team\_fk foreign key (tNo) references team(tNo),  mID numeric(6),  constraint tm\_mgr\_fk foreign key (mID) references clubMember(mID),  primary key (tNo, mID)); |
| Create table practiceSlots(  pSlotNo numeric(6) primary key,  parkLocation varchar2(30) not null,  weekDay numeric (1) not null check (weekDay between 1 and 7),  start\_time varchar2(5),  end\_time varchar2(5)) ;  Create table team(  tNo numeric(6) primary key,  tName varchar2(30) not null,  mgrID numeric (6),  constraint team\_mgr\_fk foreign key (mgrID) references Manager(mgrID) ); | | | Create table practiceBooking(  pSlotNo numeric (6),  constraint pb\_pitch\_fk foreign key (pSlotNo) references practiceSlots (pSlotNo),  tNo numeric (6),  constraint pb\_team\_fk foreign key (tNo) references team (tNo),  primary key (pSlotNo, tNo)); |
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| **1.** | **(b)** | 1. Explain clearly what *type of data integrity* each of the constraints you implemented helps you to achieve.   **(10 marks)** |
| **Marking/Solution:**  **3 marks** Not Null, Check - value constraints; ensures data meets specific requirements of business;  **4 marks**  Foreign Key – referential integrity; requires every value of one attribute of one table to exist as a value of an attribute in another;  **3 mark** Primary key – entity integrity; uniquely identify each instance of an entity | | |

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| **1.** | **(c)** | Assuming that you have created tables for the Footie AFC in your schema.  Write the SQL statements required to *insert* the following data into the relevant tables and persist it.  Explain the order in which the data must be inserted and why an instruction is needed to persist it.   |  |  |  |  | | --- | --- | --- | --- | | **Team No** | **Team Name** | **Manager** | **Team Members** | | 1 | Blue | Mr. Murinho  [jmblue@gmail.com](mailto:jmblue@gmail.com) | J. Terry | |  |  |  | E. Hazard | | 2 | Red | Mr. Klopp  [jkred@gmail.com](mailto:jkred@gmail.com) | J. Milner | |  |  |  | E.Can | | 3 | White | Mr. M. Pochettino | H.Kane | |  |  | [mpwhite@gmail.com](mailto:mpwhite@gmail.com) | [hk@whiteafc.com](mailto:hk@whiteafc.com) |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Practice Slot** | **Location** | **Day** | **Start Time** | **End Time** | **Booked by team** | | 1 | East 1 | Monday | 18.00 | 19.00 | 1 | | 2 | West 1 | Monday | 18.00 | 19.00 | 2 | | 3 | West 2 | Tuesday | 18.00 | 19.00 | 2 | | 4 | East 1 | Monday | 19.00 | 20.00 | 1 |   **(15 marks)** | |
| **Marking/Solution:**  **8 marks** correctly formatted insert statements (with field lists)  **4 marks** correct order + explanation  **3 marks** commit explanation (first DML signals transation, DBMS locks rows until commit/rollback) | | | |
| Insert into CLUBMEMBER (MID,FNAME,SURNAME,EMAIL) values (1,'J.','Terry',null);  Insert into CLUBMEMBER (MID,FNAME,SURNAME,EMAIL) values Insert into CLUBMEMBER (MID,FNAME,SURNAME,EMAIL) values (2,'E.','Hazard',null);  (3,'J.','Milner',null);  Insert into CLUBMEMBER (MID,FNAME,SURNAME,EMAIL) values (4,'E.','Can',null);  Insert into CLUBMEMBER (MID,FNAME,SURNAME,EMAIL) values (5,'H.','Kane',’hk@whiteafc.com’);  Insert into MANAGER (MGRID,MGRNAME,MGREMAIL) values (1,'Mr. Murinho','jmblue@gmail.com');  Insert into MANAGER (MGRID,MGRNAME,MGREMAIL) values (2,'Mr. Klopp','jkred@gmail.com');  Insert into MANAGER (MGRID,MGRNAME,MGREMAIL) values (3,'Mr. M. Pochettino','mpwhite@gmail.com');  Insert into PRACTICESLOTS (PSLOTNO,PARKLOCATION,WEEKDAY,START\_TIME,END\_TIME) values (1,'East 1',1,'18:00','19:00');  Insert into PRACTICESLOTS (PSLOTNO,PARKLOCATION,WEEKDAY,START\_TIME,END\_TIME) values (2,'West 1',1,'18:00','19:00');  Insert into PRACTICESLOTS (PSLOTNO,PARKLOCATION,WEEKDAY,START\_TIME,END\_TIME) values (3,'West 2',2,'18:00','19:00');  Insert into PRACTICESLOTS (PSLOTNO,PARKLOCATION,WEEKDAY,START\_TIME,END\_TIME) values (4,'East 1',1,'19:00','20:00'); | | | Insert into TEAM (TNO,TNAME,MGRID) values (1,'Blue',1);  Insert into TEAM (TNO,TNAME,MGRID) values (2,'Red',2);  Insert into TEAM (TNO,TNAME,MGRID) values (3,'White',3);  Insert into TEAMMEMBER (TNO,MID) values (1,1);  Insert into TEAMMEMBER (TNO,MID) values (1,2);  Insert into TEAMMEMBER (TNO,MID) values (2,3);  Insert into TEAMMEMBER (TNO,MID) values (2,4);  Insert into TEAMMEMBER (TNO,MID) values (3,5);  Insert into PRACTICEBOOKING (PSLOTNO,TNO) values (1,1);  Insert into PRACTICEBOOKING (PSLOTNO,TNO) values (2,2);  Insert into PRACTICEBOOKING (PSLOTNO,TNO) values (4,1);  Insert into PRACTICEBOOKING (PSLOTNO,TNO) values (3,2);  Commit; |

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| **2.** | 1. Write and explain the SQL needed to ensure that all club members have an email address which must be unique, without dropping and recreating the table.   The email addresses of all club members are given in the table below:   |  |  | | --- | --- | | **Club Member** | **Email** | | J. Terry | [jt@blueafc.com](mailto:jt@blueafc.com) | | E. Hazard | [eh@blueafc.com](mailto:eh@blueafc.com) | |  |  | | J. Milner | [jm@redafc.com](mailto:jm@redafc.com) | | E.Can | [ec@redafc.com](mailto:ec@redafc.com) | |  |  | | H.Kane | hk@whiteafc.com |   **(6 marks)** |
| **Marking/Solution:**  **3 marks** update statements to update the email addresses of clubmembers + explanation  **3 marks** alter add constraint plus explanation/alter table modify + correct use of unique + explanation   |  | | --- | | update clubmember set email='jmredafc.com' where mid=3;  update clubmember set email='ehredafc.com' where mid=4; | | update clubmember set email='eh@blueafc.com' where mid=2; | | update clubmember set email='jt@blueafc.com' where mid=1; | | ALTER table clubmember  add CONSTRAINT email\_unique unique(email);  alter table clubmember  modify (email unique); | | |
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| **2.** | 1. Write and explain the SQL needed to achieve the following, without dropping and recreating tables:   Practice slots are now booked by managers. Therefore each practice booking needs to record the manager ID, not the team no.  **(10 marks)** |
| **Marking/Solution:**  **2 marks** alter table add column + explanation  **2 marks** update using subquery + explanation  **2 marks** drop constraint + explanation  **2 marks** drop column + explanation  **2 marks** add foreign key constraint to manager + explanation  alter table practicebooking add (mgrID number(6));  update practicebooking p set mgrid=(select mgrid from team t where t.tno=p.tno);  alter table practicebooking drop constraint pb\_team\_fk ;  alter table practicebooking drop column tno;  alter table practicebooking add constraint pb\_mgr\_fk foreign key (mgrid) references manager (mgrid); | |
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| **2.** | 1. Write and explain the SQL needed to delete practice slot 3 but retain the detail of any bookings of that slot.   **(4 marks)** |
| **Marking/Solution:**  **3 marks** drop constraint from practicebooking OR reference answer part b  **1 marks** delete from practiceslots  alter table practicebooking  drop constraint PB\_TEAM\_FK;  delete from practiceslots where pslotno=3;  commit; | |

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| **3.** | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 1. Assume that you have successfully inserted all the data give in Q1 into the relevant tables.   Write the SQL to achieve the following output and explain how the SQL statement achieves this.   |  | | --- | | **Team Membership** | | J. TERRY is on team BLUE No contact email available | | E. HAZARD is on team BLUE No contact email available | | J. MILNER is on team RED No contact email available | | E. CAN is on team RED No contact email available | | H. KANE is on team WHITE Contact at hk@whiteafc.com |   **(10 marks)** | | **Marking/Solution:**  **2 marks** correct concatenation and text formatting and explanation  **3 marks**  correct use of nvl or equivalent plus explanation  **2 x 2 marks (4 marks)** correct join and explanation  **1 marks** correct use of alias plus explanation | | | Select upper(fname) || ' ' || upper (surname) || ' is on team ' || upper(tname) || ' ' || nvl(email, 'No contact available') as "Team Membership"  from teammember  join clubmember using (mid)  join team using (tno); | |  1. Suppose there is a club member J. Cruyuff, member id 6 who is not currently a member of any team.   Write the SQL to achieve the output below and explain clearly how the SQL works.   |  |  |  | | --- | --- | --- | | **FNAME** | **SURNAME** | **TNO** | | J. | Cruyuff | (null) | | H. | Kane | 3 | | J. | Milner | 2 | | E. | Can | 2 | | J. | Terry | 1 | | E. | Hazard | 1 |   **(10 marks)** |
| **Marking/Solutions:**  **4 marks** implementing left outer join correctly (correct table order, correct columns, correct syntax)  **2 marks** explaining left outer join  **2 marks** implementing order by (correct syntax, correct column)  **2 marks** explaining order by asc  select fname, surname, tno from clubmember  left outer join teammember using (mid) order by tno desc; | |

**SYNTAX TABLE**

**ALTER** **TABLE** [*schema*.]*table* *column\_clauses;*

*column\_clauses*:

ADD (*column* datatype [DEFAULT *expr*] [column\_constraint(s)] [,…] )

DROP COLUMN *column*

[CASCADE CONSTRAINTS] [INVALIDATE] CHECKPOINT *int*

MODIFY *column* datatype [DEFAULT *expr*] [column\_constraint(s)]

RENAME COLUMN *column* TO *new\_name*

**ALTER** **TABLE** [*schema*.]*table* *constraint\_clause* [,…];

*constraint\_clause*:

DROP PRIMARY KEY [CASCADE] [{KEEP|DROP} INDEX]

DROP UNIQUE (*column* [,…]) [{KEEP|DROP} INDEX]

DROP CONSTRAINT *constraint* [CASCADE]

MODIFY CONSTRAINT *constraint constrnt\_state*

MODIFY PRIMARY KEY *constrnt\_state*

MODIFY UNIQUE (*column* [,…]) *constrnt\_state*

RENAME CONSTRAINT *constraint* TO *new\_name*

**CREATE** **TABLE** *table* (

*column* datatype [DEFAULT *expr*] [column\_constraint(s)[,…]] [*,column datatype* [,…]]

[table\_constraint [,…]])

**COMMIT**

**DELETE FROM *tablename* WHERE *condition***

**DROP [TABLE *tablename*|DROP VIEW *viewname*]**

**INSERT INTO *tablename* (*column*-name-list) VALUES (*data-value-list*)**

**ROLLBACK**

**SELECT** [DISTINCT] *select\_list*

**FROM** *table\_list*

[WHERE *conditions*]

[GROUP BY *group\_by\_list*]

[HAVING *search\_conditions*]

[ORDER BY *order\_list* [ASC | DESC] ]

**SYNTAX TABLE**

***Conditions:=,>,<,>=,<=,<>,* BETWEEN .. AND.., IN *(list),*IS NULL, IS NOT NULL, LIKE**

***Logical operators:* AND, OR, NOT**

***Set operations:*  UNION, MINUS, INTERSECT**

**CASE [ expression ]**

WHEN condition\_1 THEN result\_1

WHEN condition\_2 THEN result\_2

WHEN condition\_n THEN result\_n

ELSE result

**END**

**SELECT**

... FROM table1 LEFT JOIN *table2*

ON *table1.field1* *compopr table2.field2 |* USING *clause*

... FROM table1 RIGHT JOIN *table2*

ON *table1.field1* *compopr table2.field2 |* USING *clause*

... FROM table1 INNER JOIN *table2*

ON *table1.field1* *compopr table2.field2|* USING *clause*

Key

*table1, table2* The tables from which records are combined.

*field1, field2* The fields to be joined.

compopr Any relational comparison operator: = < > <= >= or <>

**UPDATE *tablename***

**[SET *column-name=* <*data-value*>] [WHERE *condition*]**

***Column-definition = column-name* [CHAR [(*n*)] | VARCHAR2(*n*) | NUMBER [ *n*,*p*] | DATE | DATETIME] {[NOT NULL | UNIQUE | PRIMARY KEY]}**

**Oracle Functions**

Null Handling Functions: NVL, NVL2, NULLIF, COALESCE, CASE, DECODE.

Case Conversion functions - Accepts character input and returns a character value: UPPER, LOWER and INITCAP.

Character functions - Accepts character input and returns number or character value: CONCAT, LENGTH, SUBSTR, INSTR, LPAD, RPAD, TRIM and REPLACE.

Date functions - Date arithmetic operations return date or numeric values: MONTHS\_BETWEEN, ADD\_MONTHS, NEXT\_DAY, LAST\_DAY, ROUND and TRUNC.

Group Functions: SUM( [ALL | DISTINCT] expression ); AVG( [ALL | DISTINCT] expression ); COUNT( [ALL | DISTINCT] expression ); COUNT(\*); MAX(expression);MIN(expression)