FINAL EXAM: DATABASES ("BASES OF DATOS") – 11/06/07 – SCHEMA

Consider the following relational schema, which will be referred to as WORKING SCHEMA, which maintains information on the order and invoices of a retail company:

BOAT(bcode:d_bcode, **name**:d_name, **weight**:d_weight, **reg_no**: d_reg_no**)**
PK:{bcode}
NNV:{name}

MEMBER(mcode:d_mcode, **name:**d_name, **function:**d_fun, **date:**d_date, **bcode:** d_bcode**)**
PK:{mcode}
NNV:{name, date}
FK:{bcode} -> Boat
On delete cascade
On update cascade

COMPETITION(ccode:d_comp, **year:**d_year, **name:**d_name, **prize:**d_prize**)**
PK:{ccode, year}
NNV:{name}

REGATTA(rcode:d_codreg, **ccode**:d_comp, **year**:d_year, **place**:d_pla, **distance**:d_dist, **winner**:d_bcode**)**
PK:{rcode}
FK:{ccode, year} -> Competition
On delete cascade
On update cascade
FK:{rcode, winner}-> Participates
On delete restrict
On update cascade
Weak referential integrity
f(winner) = bcode
NNV:{ccode,year}

PARTICIPATES(bcode:d_bcode, **rcode**:d_codreg, **score**: d_score**)**
PK:{bcode, rcode}
FK:{rcode} -> Regatta
On delete restrict
On update restrict
FK:{bcode} -> Boat
On delete cascade
On update cascade

where the attributes and tables have the following meaning

BOAT: Description for the boats which participate in competitions.
bcode represents the code of the boat, *name* is the name of the boat, *weight* represents the weight of the boat and *reg_no* is a derived attribute which indicates the number of regattas in which the boat has participated.

MEMBER: Description for the crew members of the boats.
mcode is the code of the member, *name* is the name of the member, *function* is the task in the which he is specialised, *date* is the date in the which the crew member obtained the licence for sailing, *bcode* is the boat in the which the member is enrolled.

PARTICIPATES: Contains the information about which boats participate in each regatta.
bcode is the code of the boat which races, *rcode* is the code of regatta, *score* is the score which the boat *bcode* has obtained in the regatta *rcode*.

COMPETITION: Contains the information about the sailing competitions.
ccode is the code of the competition, for which there can be several editions in different years, *year* is the year of the edition of the competition, *name* is the name which receives the edition and *prize* is the prize, in cash, which the winner gets from that edition.

REGATTA: Contains information about each of the regattas which form the competitions.
rcode is the code of the regatta, *ccode* is the code of the competition, *year* is the year in which the competition took place, *place* is the city in which the regatta took place, *distance* is the distance or length of the regatta and *winner* is the code of the boat which won the regatta.

And consider the following extension of the previous schema. We will refer to this extension as database (DB). Empty cells represent null values:

BOAT

bcode	name	weight	n ºpart
SUI90	Alinghi	2580	0
USA98	BMW Oracle	2601	1
NZL92	New Zealand	2602	1
ESP97	Desafío Espyearl	2490	2

MEMBER

mcode	name	function	date	bcode
FIP	INSA PASTOR, FRANCISCO JOSE	Tiller	31-3-2000	ESP97
MLI	MOLINOS IBAÑEZ, LOURDES	Seafarer	4-8-1999	ESP97
GJR	JARA-RON, GUILLAUME	Tiller	7-5-2003	NZL92
BRB	BRUTTERWORTH BRAD	Skipper	6-6-2000	SUI90
CHD	DICKSON, CHRIS	Skipper	3-3-2002	USA98
MTK	KOSONEN, TOMI MARKUS		17-9-2000	

PARTICIPATES

bcode	rcode	score
NZL92	002	2
ESP97	002	0
USA98	003	0
ESP97	003	2

COMPETITION

ccode	year	name	prize
CLV	2003	Louis Vuitton Cup	9
CA	2003	America's Cup	45
CA	2007	America's Cup	50
CLV	2007	Louis Vuitton Cup	10

REGATTA

rcode	ccode	year	place	distance	winner
001	CA	2007	Valencia		
002	CLV	2007	Valencia	12,6	NZL92
003	CLV	2007	Valencia	12,6	ESP97

Final exam: "databases" – 11/06/07 – QUESTIONNAIRE TYPE A

This questionnaire has 14 questions; for each one we propose four possible answers. Only one of them is correct. The answer must be included in the answer sheet which has been handed with the exam. The maximum mark for the questionnaire is 3.5 points. The result is obtained through the formula: (Right – Wrong/3) × 0.25.

1. Given the working schema, which will the maximum and minimum cardinality be of the following expression in relational algebra?

$$(\text{Regatta } ((\text{winner, bcode})) \bowtie \text{Participates})$$

a) The minimum cardinality is 0 and the maximum Card(Regatta)xCard(Participates).
b) The minimum and maximum cardinalities match with the minimum and maximum cardinalities of the relation Participates.
c) The minimum cardinality is 0 and the maximum Card(Regatta).
d) The minimum cardinality is Card(Regatta) and the maximum Card(Participates).

2. Having the working schema into account, which query does the following expression solve in the relational algebra?

$$\text{Boat} \bowtie (\text{Participates [bcode]} - \text{Regatta}((\text{winner,bcode}))[\text{bcode}])[\text{bcode,name}]$$

a) Code and name of the boats which have participated in some regatta but have never won any.
b) Code and name of the boats which have won some regatta
c) Code and name of the boats which have won more than one regatta
d) Code and name of the boats which have not participated in any regatta

3. Given the extension of the DB which have been previously presented, which will the behaviour of the DBMS be in front of the execution of the following sentence?

INSERT INTO Regatta (rcode, ccode, year, place, distance)
VALUES ('004', 'CA', 2003, 'Auckland', 13)

a) The tuple will not be inserted because an error will happen since an attribute is missing.
b) Insert the tuple Regatta('004', 'CA',2003, 'Auckland', 13, NULL)
c) The tuple will not be inserted because the integrity constraint "FK:{rcode,winner}-> Participates" is violated.
d) If the evaluation mode for the referential integrity is immediate, the tuple will not be inserted, but it will be if it is deferred.

4. How can we include the following constraint: "Every boat which participates in a regatta has at least an assigned member crew"?

a) Including a foreign key to member in the relation boat with a non-null value constraint.
b) Including a non-null value constraint over *bcode* in the relation member.
c) Including a general constraint over the tables Participates and Member.
d) There is no need to add or change anything because this constraint is already expressed in the schema.

5. Given the extension of the DB which have been previously presented, which will the behaviour of the DBMS be in front of the execution of the following sentence?

DELETE FROM Participates WHERE bcode ='NZL92'

a) No modification will be performed on the database
b) Only the tuple Participates('NZL92', '002', 2) will be deleted
c) The tuples Participates('NZL92', '002', 2), and Regatta(002,'CLV', 2007, 'Valencia',12.6, NZL92) will be deleted
d) The tuple Participates('NZL92', '002', 2) will be deleted and a null value will be placed in the attribute *winner* of the tuple with code 002, i.e. Regatta(002,'CLV', 2007, 'Valencia',12.6, NULL)

6. Which constraint over the working schema does the following SQL instruction impose?

```
CREATE ASSERTION R1
CHECK (NOT EXISTS (SELECT * FROM Boat B
                   WHERE (SELECT COUNT(*)
                          FROM Member T
                          WHERE B.bcode = T.bcode) < 6 AND
                          EXISTS (SELECT * FROM Participates P
                                  WHERE B.bcode = P.bcode)));
```

a) Only the boats with less than six crew members can participate in a regatta.
b) All the boats must have at least six crew members and have also participated in some regatta.
c) Only the boats with more than five crew members can participate in a regatta.
d) All the boats must participate in some regatta.

7. Consider the transaction T executed over the DB in the Oracle10 DBMS.

```
COMMIT;
UPDATE Regatta SET winner = 'ESP97' WHERE rcode = '001';
INSERT INTO Participates (rcode, bcode) VALUES ('001', 'ESP97');
COMMIT;
```

which of the following statements is TRUE?

a) *T* will be confirmed and will comply with the property of durability.
b) *T* will be confirmed if the foreign key in Regatta is defined as INITIALLY IMMEDIATE.
c) *T* will be confirmed if the foreign key in Regatta is defined as INITIALLY DEFERRED.
d) *T* will fail because there is no score assigned in the insertion in *Participates*

8. If, during the execution of a transaction *T*, a main memory failure happens, which of the following statements is TRUE?

a) We will have to recover the most recent backup of the database and redo all the transactions in the logfile from that date on.
b) If there is an immediate update storage strategy, only the confirmed transactions since the last checkpoint will have to be redone.
c) If there is an immediate update storage strategy, all the confirmed transactions since the last checkpoint will have to be redone and all the unconfirmed transactions since the last checkpoint will have to be undone.
d) The transaction *T* will be stored immediately.

9. Which of the following statements about checkpoints is TRUE?

a) They are used when secondary storage is lost.
b) Allow a more efficient recovery in front of main memory failures.
c) The execution of transactions is not suspended during the checkpoint recording.
d) Allow a more efficient recovery in front of secondary storage failures which affect the database.

10. Which statement referring to the working schema is TRUE?
a) There cannot be two competitions with the same code and name.
b) All the members are associated to one boat and only one boat.
c) When a member is deleted the boat to which he belongs will also be deleted in cascade.
d) A boat which has won some regatta cannot be deleted.

11. Given the working schema, which of the following statements is TRUE?
a) A boat which participates in a regatta can only be deleted if it is the only boat which participates in the regatta.
b) A boat which participates in several regattas can have different members in each of them.
c) Every regatta has at least one participant.
d) A regatta can only belong to one competition.

a)

12. If in the physical implementación of the database DB, we use a cluster for the relations Boat and Member, which of the followings statements is FALSE?
a) The tuples with the same value in the attribute *bcode* in Member are stored in the same secondary memory block.
b) The modification of the attribute *bcode* in the relation Member would be an expensive operation since it will force a change of secondary memory block for the corresponding tuple in Member.
c) The cluster key would be the attribute *bcode*, since it is the one which is used to perform the join between both relations.
d) The modification of the attribute *bcode* in the relation Boat would be a very expensive operation since it will imply a distribution of the members in different secondary memory blocks.

13. For the creation of a view in SQL, the sentence WITH CHECK OPTION
a) Cannot be used.
b) Forbids performing update operations to unauthorised users.
c) Forbids the creation of a view if an integrity constraint is violated.
d) Forbids updates over the view which violate its definition.

14. Which of the followings statements is FALSE?
a) When a logical binding is performed, the logical schema is transformed into the internal schema.
b) The behaviour of applications is less efficient the more frequent the binding is
c) When the binding is performed, data independence disappears.
d) The relational schema for a database is placed at the logical level in the three-level database architecture.

FINAL EXAM: DATABASES – 11/06/07 – Problems

Given the working schema presented before, solve the following exercises in standard SQL:

1) List the code and the name of the boats without members, which have participated in some regatta **(0.5 points)**.

2) List the code and the name of the members which obtained sailing licence in 2005 and are not enrolled in any boat **(0.5 points)**.

3) List the code and the name of the boats which have more than 5 members **(0.5 points)**.

4) List the code and the name of the boats which have won more than a regatta in the same edition of any competition **(0.75 points)**.

5) List the code and the name of all the boats which have participated in the competition with name "Louis Vuitton Cup", in the edition 2007, indicating the number of members of each one **(1 point)**.

6) List the code and the name of those boats which have participated in all the editions of the competition with name "Louis Vuitton Cup" (if there are no editions, do not list any boat) **(1 point)**.

7) List the code and the name of the boat and the total amount of assigned members for those boats which have the greatest number of members among all the boats **(1 point)**.

8) Considering that the value of the attribute *reg_no* of the relation BOAT is a derived attribute which corresponds to the number of regattas in which the boat has participated:

   8.1) Apart from the INSERTION operation in the relation PARTICIPATES, indicate the operations which might affect the value of this attribute. For each of these operations specify the name of the relation (and in case of an update the attribute or attributes involved) and how the value of the attribute *reg_no* of the relation BOAT should be modified **(0.5 points)**.

   8.2) Implement a trigger to cover the INSERTION operation in the relation PARTICIPATES **(0.75 points)**.

SOLUTIONS TO THE QUESTIONNAIRE:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
c	a	b	c	a	c	c	c	b	d	d	d	d	a

SOLUTIONS TO THE PROBLEMS:

1.

```
SELECT DISTINCT B.bcode, B.name
FROM Boat B, Participates P
WHERE B.bcode = P.bcode AND
                NOT EXISTS  (  SELECT *
                                FROM Member T
                                WHERE T.bcode = B.bcode );
```

2.

```
SELECT T.tcode, T.name
FROM Member T
WHERE T.date >= '1/1/2005' AND
          T.date<= '31/12/2005' AND
          T.bcode IS NULL ;
```

3.

```
SELECT B.bcode, B.name
FROM Boat B
WHERE 5 < (SELECT COUNT(T.tcode)
                FROM Member T
                WHERE T.bcode = B.bcode);
```

4.

```
SELECT DISTINCT b.bcode, b.name
FROM Regatta R1, Regatta R2, Boat B
WHERE B.bcode = R1.winner AND
          B.bcode = R2.winner AND
          R1.ccode =R2.ccode AND
          R1.year =R2.year AND
          R1.rcode <>R2.rcode ;
```

Otra posible solución:

```
SELECT DISTINCT b.bcode, b.name
FROM Boat B, Regatta R
WHERE 2 <= ( SELECT COUNT (R1.rcode)
                FROM Regatta R1
                WHERE B.bcode = R1.winner AND
                          R1.year = R.year AND
                          R1.ccode = R.ccode ) ;
```

5.

```
SELECT B.bcode, B.name, COUNT(T.tcode)
FROM Boat B LEFT JOIN Member T ON (B.bcode = T.bcode)
WHERE b.bcode IN ( SELECT P.bcode
                   FROM Participates P, Regatta R, Competition C
                   WHERE    R.ccode = C.ccode AND
                            C.name = “Louis Vuitton's Cup” AND
                            P.rcode = R.rcode AND
                            R.year = 2007)
GROUP BY B.bcode, B.name ;
```

6.

```
SELECT B.bcode, B.name
FROM  Boat B
WHERE NOT EXISTS
          ( SELECT *
            FROM Competition C
            WHERE C.name = “Louis Vuitton's Cup” AND
                  NOT EXISTS ( SELECT *
                               FROM Participates P, Regatta R
                               WHERE R.year = C.year AND
                                     R.ccode = C.ccode AND
                                     P.rcode = R.rcode AND
                                     B.bcode = P.bcode ) AND
                  EXISTS ( SELECT *
                           FROM Competition C
                           WHERE C.name = “Louis Vuitton's Cup” ) ) ;
```

7.

```
SELECT B.bcode, B.name, COUNT (*)
FROM Boat B, Member T
WHERE B.bcode = T.bcode
GROUP BY B.bcode, B.name
HAVING COUNT(*) = ( SELECT MAX( COUNT(*) )
                    FROM Member T
                    GROUP BY T.bcode ) ;
```

8.

Operation	**Relation**	**Score**
Insertion	Participates	Reg_no +1
Deletion	Participates	Reg_no -1
Update (bcode)	Participates	Old.reg_no-1 New.reg_no+1
Insertion	Boat	Reg_no = 0
Update (reg_no)	Boat	PROHIBIR