

Consider the following relational schema, which will be referred to as WORKING SCHEMA, which maintains information about sailing competitions (regattas):

**BOAT**(*bcode*: d1, *name*: d2, *weight*: d3)

PK:{*bcode*}

NNV:{*name*}

**MEMBER**(*mcode*: d5, *name*: d2, *bcode*: d1)

PK:{*mcode*}

NNV:{*name*}

FK:{*bcode*} -> Boat On delete set to null

On update cascade

**COMPETITION**(*ccode*: d8, *year*: d9, *name*: d2, *prize*: d10)

PK:{*ccode*, *year*}

NNV:{*name*}

**REGATTA**(*rcode*: d11, *ccode*: d8, *year*: d9, *place*: d12, *winner*: d1)

PK:{*rcode*}

NNV:{*ccode*}

FK:{*ccode*, *year*} -> Competition On delete cascade

On update cascade

Referential integrity *to be defined*

FK:{*rcode*, *winner*} -> Participates f(*winner*) = *bcode*

On delete cascade

On update restrict

Referential integrity *to be defined*

**PARTICIPATES**(*bcode*: d1, *rcode*: d11, *score*: d14)

PK:{*bcode*, *rcode*}

FK:{*rcode*} -> Regatta On delete cascade

On update restrict

FK:{*bcode*} -> Boat On delete cascade

On update restrict

**BOAT:** Boats that participate in competitions. *bcode* represents the code of the boat, *name* is the name of the boat, and *weight* represents the weight of the boat.

**MEMBER:** Crew members of the boats. *mcode* is the code of the member, *name* is the name of the member, and *bcode* is the boat the member is enrolled in.

**PARTICIPATES:** 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 that the boat *bcode* has obtained in the regatta *rcode*.

**COMPETITION:** 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 of the edition, and *prize* is the prize that the winner gets from that edition.

**REGATTA:** Each of the regattas that make up the competitions. *rcode* is the code of the regatta, *ccode* is the code of the competition, *year* is the year when the competition took place, *place* is the city where the regatta took place, and *winner* is the code of the boat that won the regatta.

Consider the following extension of the previous schema. We will refer to this extension as database (DB).

BOAT		
bcode	name	weight
USA98	BMW Oracle	2601
NZL92	New Zealand	2602
ESP97	Desafío Español	2490

COMPETITION			
ccode	year	name	prize
CLV	2007	Louis Vuitton	9
CA	2003	Americ'a Cup	45
CA	2007	Americ'a Cup	
CLV	2008	Louis Vuitton	10

MEMBER		
mcode	name	bcode
BRB	BRUTTERWORTH	ESP97
CHD	DICKSON	USA98
MTK	KOSONEN	ESP97

PARTICIPATES		
bcode	rcode	score
NZL92	001	2
USA98	002	0
ESP97	002	0
ESP97	003	2

REGATTA				
rcode	ccode	year	place	winner
001	CA	2007	Valencia	NZL92
002	CLV	2007		USA98
003	CLV	2008	Valencia	ESP97

Lastname: \_\_\_\_\_ Name: \_\_\_\_\_

1) (30 points) Considering the working schema, indicate if the following sentences are **true** or **false**. Justify your answer.

a. A regatta can be celebrated only one year.

True, the attribute "year" of "Regatta" cannot contain more than one value.

b. A boat cannot participate in more than one regatta in the same year.

False. A boat can participate in more than one regatta because the PK of "Participates" is the bcode and the rcode, and there is no constraint to avoid more than one regatta in the same year.

c. A regatta can only belong to one competition.

True. Each tuple in Regatta can have only a pair of values (ccode,year), and this pair is the PK of Competition.

d. One member can be member of the crew of only one boat.

True, the attribute "bcode" of "Member" cannot contain more than one value.

e. Every boat must participate at least in one regatta.

False. There can exist a value of bcode in Boat the is not in bcode of Participates

f. Every regatta will have one, and only one winner.

"Only one", because the attribute *winner* can contain only one value. Must it have **one** value? It depends on the type of referential integrity of {rcode, winner}. If the **referential integrity is weak or partial**, rcode could be NOT NULL and winner NULL, so it is possible to have a regatta with no winner. rcode is the PK, therefore it cannot be null. If the **referential integrity is full**, "winner" cannot be null, therefore must be a winner.

2) (5 points) Answer the following questions:

a. What is the *Participates* cardinality?

4

b. What is the *Participates* degree?

3

3) (20 points) Fill the cells in the following table with YES or NO indicating whether the referential integrity would be fulfilled in each of the possible cases of Referential Integrity when the tuple with: **rcode=004**, **ccode='CLV'**, **winner=ESP97**, **year=X**, is inserted in the *Regatta* relation. X will take the values indicated in the table.

X	Weak R.I.	Partial R.I.	Full R.I.
NULL	Yes	Yes	No
2007	Yes	Yes	Yes
2009	No	No	No

- 4) (10 points) How can we include the following constraint: “Every boat that participates in a regatta has at least one assigned member crew”?
- By including a foreign key to *Member* in the relation *Boat* with a non-null value constraint.
  - By including a non-null value constraint over *bcode* in the relation *Member*.
  - By including a general constraint over the tables *Participates* and *Member*.
  - There is no need to add or change anything because this constraint is already expressed in the schema.

5) (15 points) Which query represent the following expression?

$(\text{Boat}[\text{bcode}] - \text{Participate}[\text{bcode}]) \otimes_{\text{bcode}} \text{Member}[\text{name}]$

Names of the members of the crews of boats which have participate in no regatta.

6) (20 points) Complete the content of the tables after the execution of the following sentence:

DELETE FROM Competition WHERE ccode='CLV' AND year = 2007

BOAT		
bcode	name	weight
USA98	BMW Oracle	2601
NZL92	New Zealand	2602
ESP97	Desafío Español	2490

COMPETITION			
ccode	year	name	prize
CLV	2007	Louis Vuitton	9
CA	2003	Americ'a Cup	45
CA	2007	Americ'a Cup	
CLV	2008	Louis Vuitton	10

MEMBER		
mcode	name	bcode
BRB	BRUTTERWORTH	ESP97
CHD	DICKSON	USA98
MTK	KOSONEN	ESP97

PARTICIPATES		
bcode	rcode	score
NZL92	001	2
USA98	002	0
ESP97	002	0
ESP97	003	2

REGATTA				
rcode	ccode	year	place	winner
001	CA	2007	Valencia	NZL92
002	CLV	2007		USA98
003	CLV	2008	Valencia	ESP97