

**Relational Databases - Comp2400/Comp6240**  
**Mid-Semester Test, 2nd Semester 2007**

|                       |  |
|-----------------------|--|
| <b>Name</b>           |  |
| <b>Student Number</b> |  |

**Instructions**

- answer all questions
- write your answers on this paper in the spaces provided
- reading time: 5 minutes
- writing time: 45 minutes
- marks: 20

## Question 1

Several parts of this question refer to this database schema.

- Relation schemas (Primary keys are shown underlined)

*message*(*forum* : *string*, *fmsgID* : *integer*, *text* : *string*, *responseTo* : *integer*)

The attribute *fmsgID* identifies the message within the forum.

- The attributes *message.forum*, *message.responseTo* are a foreign key referencing *message.forum*, *message.fmsgID*.

### 1. (a)

[1 mark]

Give an example database state that violates entity integrity. Make sure all other integrity constraints are satisfied, and only include a single violation of entity integrity.

| <u>forum</u> | <u>fmsgID</u> | text | responseTo |
|--------------|---------------|------|------------|
|              |               |      |            |
|              |               |      |            |

### 1. (b)

[1 mark]

Give an example database state that violates referential integrity. Make sure all other integrity constraints are satisfied, and only include a single violation of referential integrity.

| <u>forum</u> | <u>fmsgID</u> | text | responseTo |
|--------------|---------------|------|------------|
|              |               |      |            |
|              |               |      |            |

**1. (c)**

**[1 mark]**

Write an SQL query listing the forum (*forum*) and forum message identifier (*msgID*) of the messages with empty texts.

**1. (d)**

**[2 marks]**

Write an SQL query listing the messages belonging to forum “database help” which are responses to messages which are not responding to any message.

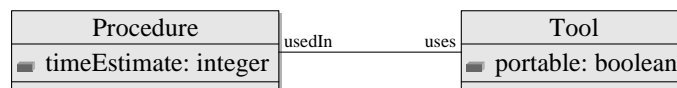
**1. (e)**

**[2 marks]**

The *catalog* of a database management system allows the data to be “self-describing”. Describe two of the main relations we might find in the catalog, along with their most important attributes.

## Question 2

Several parts of this question relate to the following UML class diagram.



**2. (a)**

**[1 mark]**

Add appropriate multiplicities to the association ends in the class diagram.

**2. (b)**

**[1 mark]**

Add to the class diagram above to cater for the following new requirements. The organisation is expanding and will have several workshops. The workshops will have different types of tools available. Queries will be needed to determine which workshops have the tools required to perform a given procedure.

**2. (c)**

**[2 marks]**

Draw an object Diagram representing the following situation. There are two portable tool types, spanner and drip tray. Hoist is a non-portable type of tool. Oil change is a procedure that uses a spanner and a drip tray and is estimated to take 30 minutes. The tyre rotation procedure uses a spanner and a hoist and is estimated to take 30 minutes. The indicator check procedure is estimated to take 5 minutes, and uses no tools.

**2. (d)**

**[3 marks]**

Use SQL `create table` commands like the example below to give a translation of the class diagram as a relational schema. Be sure to indicate appropriate primary and

foreign key constraints, and NOT NULL constraints. Use a translation procedure seen in lectures, which does not produce unnecessary tables.

```
CREATE TABLE tableName (  
  attrib1 type1,  
  attrib2 type2 NOT NULL,  
  PRIMARY KEY(attrib1),  
  FOREIGN KEY(attrib2) REFERENCES otherTable(otherAttrib)  
);
```

### Question 3

#### 3. (a)

[2 marks]

Indicate whether each of the following statements are true or not, using a  $\surd$  (true) or a  $\times$  (false).

1.  $A \cup A = A \cap A$
2.  $a \subseteq \{a, b, c\} \cup \{x, y, z\}$
3.  $\sigma_c(R) \cap \sigma_{\neg c}(R) = R$
4.  $\{x, y\} \subseteq \{x\} \times \{y\}$
5.  $\pi_X(\pi_Y(R)) = \pi_X(R)$
6.  $R \cup \rho_{S(b,a)}(R) = R$

**3. (b)**

**[1 mark]**

Write  $\{x.a, y.b \mid R(x) \wedge S(y) \wedge x.s = y.s\}$  as an SQL query.

**3. (c)**

**[1 mark]**

Write  $\sigma_{s>10}(A \bowtie_{d=dn} B)$  as an SQL query.

**3. (d)**

**[1 mark]**

Indicate which of the following are functions using a  $\surd$  (true) or a  $\times$  (false).

1. The set of pairs  $(a, a)$  where  $a \in A$
2. The set of pairs  $(a, 11)$  where  $a \in A$
3. The set of pairs  $(11, a)$  where  $a \in A$

**3. (e)**

**[1 mark]**

Are  $R$  and  $\pi_{x,y,z}(R)$  union compatible? Explain why or why not?