TECHNISCHE UNIVERSITEIT DELFT
Faculteit Elektrotechniek, Wiskunde en Informatica

Final

TI1506 Web and Database Technology

Friday, February 3rd 2017
09.00-11.00

INSTRUCTIONS:

- This exam consists of 2 parts (DB and Web) and a total of 40 multiple-choice questions. All questions are worth an equal number of points.
- The usage of books, notes, old exams, and other written resources is explicitly **FORBIDDEN** during the exam. The use of electronic aids such as smart-phones, laptops, etcetera, is **ALSO NOT** allowed.
- There is only one right answer for each question. If you think there are more, pick the best one.
- You are not allowed to make corrections on the multiple-choice answer form (MAF). You are therefore advised to first mark the answers on this exam and later copy them to the MAF. If you need to make corrections anyway, ask for a new form and copy all your answers to it.
- You are not allowed to take the exam sheet with you after the exam. We will publish online the text of the exam together with its solutions.
- Note that the order of the answers on your MAF form is not always A-B-C-D.
- Be sure to fill in all header information on the MAF. Enter your *student number* on the form with digits as well as by filling the boxes.
- Sign the MAF. Without your signature, the form is not valid. Since you might forget this at the end, you are advised to do this at the start of the exam.

Part 1 – Web (17 questions)

QUESTION 1. Consider the server-side code below running at `my.site.nl` (port 3000).

```
1   var express = require("express");
2   var http = require("http");
3   var cookies = require("cookie-parser");
4   var sessions = require("express-session");
5   var app = express();
6
7   app.use(cookies("not-a-secret"));
8   app.use(sessions("not-a-secret"));
9   http.createServer(app).listen(3000);
10
11  app.get("/countme", function(req, res){
12      var session = req.session;
13      console.log(session);
14      if(session.views) {
15          session.views++;
16          res.send("You have been here "+session.views +" times!");
17      }
18      else {
19          session.views = 1;
20          res.send("This is your first visit");
21      }
22  });
```

A user starts up the browser (which contains no cookies so far) and accesses

`http://my.site.nl:3000/countme.`

What will be logged on the server's console (line 13)?

A) {}

B)
```
Session {
   cookie:
   { path: '/',
      _expires: null,
      originalMaxAge: null,
      httpOnly: true }}
```

C)
```
Session {
   cookie:
   { path: '/',
      _expires: null,
      originalMaxAge: null,
      httpOnly: true },
   views: null}
```

D) { views: null }

QUESTION 2. Consider the following node.js snippet:

```
1   app.get('/[Gg]let(Admin|Student)?Users*', function(req, res){
2       res.end("Hello World!");
3   });
```

and these four routes:

```
[1] /getStudentUsersss
[2] /getStudentAdminUser
[3] /GetUser
[4] /etAdminUsers
```

Which of these 4 routes will match the route defined in `app.get()` and return "Hello World!" in the HTTP response?

A) Only [1], [2] and [3]
B) Only [1] and [3]
C) Only [1] and [4]
D) Only [2], [3] and [4]

QUESTION 3. Consider the two files, `foo.js` and `bar.js`:

`foo.js`:

```
1   module.exports.username = "my_username";
2   module.exports.password = "my_password";
3   module.exports.color = "orange";
4   module.exports = function() {
5       return function(){
6           return "green";
7       };
8   };
```

`bar.js`:

```
1   var foo1 = require("./foo");
2   console.log( foo1()() );
```

What is the console output when running `node bar.js` ?

A)
```
{ username: 'my_username',
  password: 'my_password',
  color: 'orange',
  _: [Function] }
```

B) `[Function]`

C) `TypeError: foo1(…)(…) is not a function`

D) `green`

QUESTION 4. Consider the two files, `foo.js` and `bar.js`:

`foo.js`:

```
1   module.exports.my_pets = function() {
2       return {
3           my_cats: ["Minnie", "Mickey"],
4           my_dogs: ["Pluto", "Goofy"],
5           my_fish: ["Charlie"]
6       };
7   };
```

`bar.js`:

```
1   var foo1 = require("./foo").my_pets;
2   foo1()["my_cats"].push("Trick");
3   console.log(foo1.my_cats);
4   var foo2 = require("./foo").my_pets();
5   console.log(foo2.my_cats);
```

What is the console output when running `node bar.js` ?

A)
```
undefined
[ 'Minnie', 'Mickey' ]
```

B)
```
[ 'Minnie', 'Mickey', 'Trick' ]
[ 'Minnie', 'Mickey' ]
```

C)
```
[ 'Minnie', 'Mickey', 'Trick' ]
[ 'Minnie', 'Mickey', 'Trick' ]
```

D)
```
undefined
[ 'Minnie', 'Mickey', 'Trick' ]
```

QUESTION 5. The browser B currently has no stored cookies. A user starts up B today and accesses `http://tudelft.nl/`. In the response, the server sends the following cookies to B:

```
Set-Cookie: sid=fd332d; Expires=Fri, 01-Aug-2016 21:47:38 GMT; Path=/;
               Domain=tudelft.nl
Set-Cookie: font=courier; Path=/; Domain=tudelft.nl
Set-Cookie: fsize=10; Expires=Thu, 01-Jan-2023 00:00:01 GMT; Path=/;
               Domain=tudelft.nl
Set-Cookie: view=mobile; Path=/; Domain=tudelft.nl; secure; HttpOnly
Set-Cookie: last_access=-2; Path=/; Domain=tudelft.nl
```

B crashes 10 minutes later and the user restarts B. How many of those cookies are accessible to the user with client-side JavaScript (i.e. `document.cookie`) after the restart of B?

A) 1
B) 2
C) 4
D) 5

QUESTION 6. Which of the following statements about signed cookies is correct?

A) A signed cookie enables the server to issue an encrypted value to the client, that cannot be decrypted by the client.
B) A signed cookie enables the server to verify that the issued cookie is returned by the client unchanged, without having to store the original issued cookie on the server.
C) The value of a signed cookie is encrypted with HMAC to avoid man-in-the-middle attacks. The client can decrypt the value with a previously negotiated key.
D) The value of a signed cookie is always created by the client. The signed attribute indicates to the server that the cookie was generated by the client.

QUESTION 7. Consider the following node.js script:

```
1   var express = require("express");
2   var http = require("http");
3   var app = express();
4   var users = [];
5   users["admins"] = ["Mickey", "Minnie", "Daisy"];
6   users["instructors"] = ["Trick", "Track"];
7   users["students"] = ["Pluto", "Goofy"];
8
9   app.get('/users/:x/:y',
10      function(req, res, next){
11          if(users[req.params.x]){
12              next();
13          }
14          else {
15              console.log("Error: unknown 1st routing param!");
16          }
17      },
18      function(req, res, next){
19          var b = false;
20          users[req.params.x].forEach(function(e){
21              if(e === req.params.y){
22                  b = true;
23              }
24          });
25          next();
26      },
27      function(req, res, next){
28          res.send("Known user/role combination");
29          next();
30      }
31  );
32  app.get('/users/:x/:y', function(req, res, next){
33      console.log("Routing parameters: "+req.params.x+"/"+req.params.y);
34
35  });
36  http.createServer(app).listen(3000);
```

What happens when a user accesses `http://localhost:3000/users/admins/Pluto/` in the browser (assuming that the node.js script was started on the same machine)?

A) On the server-side, the following is logged to console:
`Routing parameters: admins/Pluto`

The browser displays:
`Known user/role combination`

B) On the server-side, the following is logged to console:
`Error: unknown 1st routing param!`
`Routing parameters: admins/Pluto`

The browser displays nothing.

C) On the server-side nothing is logged to console.
The browser displays nothing.

D) On the server-side, the following is logged to console:
`Routing parameters: admins/Pluto`

The browser displays:
`[]`

QUESTION 8. Consider the following node.js script `bar.js`:

```
1   var fs = require('fs');
2   var counter;
3   function f(){
4       fs.readFile('app.counter', function(err, fileContents){
5           counter = parseInt(fileContents); //app.counter contains 101
6           counter += 20;
7           return true;
8       });
9   }
10  f();
11  console.log(counter);
```

For your information, `fs.readFile` has the following signature: `fs.readFile(file[, options], callback)`; it asynchronously reads the entire contents of a file. The `callback` is passed two arguments `(err,data)`, where `data` is the contents of the file. What is the console output when running `node bar.js` ?

A) `TypeError: Cannot read property 'counter' of undefined.`
B) `101`
C) `121`
D) `undefined`

QUESTION 9. Consider the following node.js script `bar.js`:

```
1   var ejs = require('ejs');
2   var people = ["Mickey", "Minnie", "Pluto", "Goofy"];
3
4   var func = function(e){
5       if(e){
6           return e.pop();
7       }
8       return "";
9   }
10
11  //var template = ???
12  //var context = ???
13
14  console.log(ejs.render(template, context));
15  console.log(ejs.render(template, context));
16  console.log(ejs.render(template, context));
17  console.log(ejs.render(template, context));
```

Running `node bar.js` should yield the following four lines of output:

```
Goofy
Pluto
Minnie
Mickey
```

Missing right now are lines 11 and 12 of this script. Which of the following snippets will yield the correct output?

A)
```
var template = '<% f(e); %>';
var context = {
    e: people,
    f: func
};
```

B)
```
var template = '<% f(e); %>';
var context = {
    people,
    func
};
```

C)
```
var template = '<%= f(e); %>';
var context = {
    people: e,
    func: f
};
```

D)
```
var template = '<%= f(e); %>';
var context = {
    e: people,
    f: func
};
```

QUESTION 10. After accessing `http://www.login.meebo.com` for the first time, the server sent the following four cookies to browser B (assume this happening today):

```
Set-Cookie: ID1=32s; Path=/admin; Expires=Fri, 30 Jan 2018 01:01:01 GMT
Set-Cookie: ID2=532; Domain=meebo.com; Path=/;
                  Expires=Fri, 30 Jan 2018 01:01:01 GMT
Set-Cookie: ID3=ssd33dd; Domain=login.meebo.com; Path=/admin; secure;
                  Expires=Fri, 30 Jan 2019 01:01:01 GMT; HttpOnly
Set-Cookie: ID4=bf1; Domain=www.login.meebo.com; Path=/todos;
                  Expires=Fri, 30 Jan 2020 01:01:01 GMT; HttpOnly
```

Next, B tries to access `http://login.meebo.com/admin`. How many of the four cookies are sent back to the server?

A) 1
B) 2
C) 3
D) 4

QUESTION 11. Which of the following statements about first & third-party cookies are **correct**?

[1] Third-party cookies originate from the same domain as first-party cookies.
[2] Third-party cookies and first-party cookies are stored in the same cookie storage within the browser.
[3] Besides the `secure` and `signed` flag (available to first-party cookies), third-party cookies can in addition set the `persistent` flag.
[4] A single cookie can be a first-party cookie and a third-party cookie – depending on the URL the browser requests.

A) Only [2] and [3]
B) Only [2] and [4]
C) Only [1], [3] and [4]
D) All the above.

QUESTION 12. `Referer` is an HTTP request header field that contains the address of the previous web page from which a link to the currently requested page was followed. Validating the `Referer` header is a good way to protect a Web application from which threat?

A) OS command injection
B) Cross-site scripting
C) Missing function level access control
D) Unvalidated redirects and forwards

QUESTION 13. Which of the following statements **correctly** describe the roles in the OAuth 2.0 authorization framework?

[1] The resource owner grants access to a protected resource.
[2] The resource server hosts the protected resource and is capable of accepting and responding to protected resource requests using access tokens.
[3] The authorization server issues access tokens to the resource owner after successfully authenticating the client and obtaining authorization.
[4] The authorization server makes a protected resource request on behalf of the client and with its authorisation.

A) Only [1] and [2]
B) Only [2] and [4]
C) Only [1] and [3]
D) Only [3] and [4]

QUESTION 14. You write a Web application that contains a session management component. You decide to use as session ID the concatenation of the current POSIX time (i.e. the number of seconds elapsed since 00:00:00 UTC January 1, 1970) and a counter starting at 100 that is incremented by 1 each time a new user requests a session at the same POSIX timestamp. Which main vulnerability arises in this scenario?

A) Reflected XSS
B) Credential stuffing
C) Man-in-the-browser attack
D) Session hijacking

QUESTION 15. Web portals may secure themselves against CSRF attacks using CSRF tokens. Those tokens often appear as hidden fields in HTML forms:

```
<form action="/transfer.do" method="post">
  <input type="hidden" name="CSRFToken" value="OT...A">
  ...
</form>
```

Which of the following characteristics should a CSRF token have?

[1] The token should be verifiable on the client-side.
[2] The token should be unique per user session.
[3] The token should allow re-authentication through CAPTCHAs.
[4] The token should not be guessable.
[5] The token should contain a hash of the session ID.

A) Only [1] and [3]
B) Only [2] and [4]
C) Only [3] and [5]
D) All the above.

QUESTION 16. Which of the following statements concerning SQL injections are **incorrect**?

[1] SQL injection vulnerabilities occur when user input is used in the construction of SQL queries without input validation or constraint checks.
[2] The use of prepared statements is an ineffective defence against SQL injection attacks.
[3] SQL injection attacks do not allow attackers to change existing data, only to view them.
[4] SQL injections allow an attacker to execute SQL queries on a database under the privileges of the user connected to the database.
[5] SQL injection attacks can be prevented by proper use of client-side JavaScript to validate user input.

A) Only [3], [4] and [5]
B) Only [1], [2], [3] and [4]
C) Only [2], [3] and [5]
D) Only [1], [2] and [4]

QUESTION 17. Consider the following two abilities a malicious user (the attacker) may have after having managed to intercept your server's inbound network traffic:

[1] The attacker can eavesdrop (i.e. read all HTTP requests your server receives)
[2] The attacker can drop (i.e. delete) HTTP requests bound for your server

Which of the following threats **cannot** be executed directly with these abilities?

A) Denial of service
B) Data loss
C) Defacement
D) Unauthorized access

Part 2 – Database (23 questions)

QUESTION 18. Which of the following statements does **not** correctly describe a property of a Relational Catalogue in RDBMs?

- **A)** The Relational Catalogue contains the data dictionary.
- **B)** The Relational Catalogue contains data about the users of the database.
- **C)** The Relational Catalogue contains the physical storage structures.
- **D)** The Relational Catalogue contains data about the applications using the database.

QUESTION 19. Which of the following statements does **not** correctly describe a potential source of redundancy in an EER diagram?

- **A)** Attributes whose values can be derived, for each occurrence of an entity, from values of other attributes of the same occurrence.
- **B)** Relationships that can be derived from other relationships of cardinality greater than 2.
- **C)** Attributes whose values can be derived, for each occurrence of an entity, from attributes of other entities, usually by means of aggregate functions.
- **D)** Relationships that can be derived from other relationships in the presence of cycles.

QUESTION 20. Consider the ER diagram in Figure 1. Which of the following statements does **not correctly** describe the mini-world modelled by the diagram?

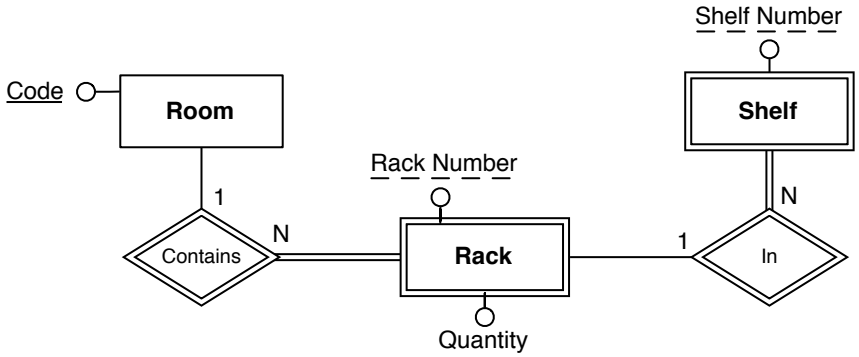

Figure 1 - An ER Diagram from a lecture's slide

- **A)** `Rack` is a weak entity type having `Room` as identifying entity type.
- **B)** A `Rack` is identified by a `Rack Number` and a room `Code`.
- **C)** A `Shelf` is a weak entity type, having `Room` and `Rack` as identifying entities.
- **D)** A `Shelf` is identified by a `Shelf Number` and a `Rack Number`.

QUESTION 21. Why do we need to remove *specializations* from an EER diagram when transforming it into a relational model?

- **A)** Because the relational model does not allow for multiple tables to have the same primary key attributes.
- **B)** Because the value-based nature of relationships in the relational model does not allow for tuples from different tables to be connected if their primary key is not composed by the same set of attributes.
- **C)** Because the value-based nature of relationships in the relational model cannot express relationships between an entity type and its entity set.
- **D)** Because the relational model only allows relationships between entity types if the specialization is *total* and *overlapping*.

QUESTION 22. Which of the following statements about the transformation process of an EER model into a logical schema is **correct**?

- **A)** In a one-to-one relationship between two entities, the two entities are generally described together, with a single table in the logical schema.
- **B)** A one-to-many relationship must be converted into a one-to-one relationship if the relationship has no attributes. The resulting EER model will be equivalent to the original one.
- **C)** When a one-to-many relationship has relationship attributes, a new table for these attributes must be added in the logical schema.
- **D)** When at least one of the entities in a one-to-one relationship has total participation, a foreign key translation should be adopted.

QUESTION 23. Which of the following statements about document databases is **not correct**?

- **A)** They store data organized as aggregate records accessed by ID values.
- **B)** They store data organized as structured documents accessed by ID values.
- **C)** They do not allow optimized data structures for fast query execution
- **D)** They do not support a declarative query language.

QUESTION 24. Which of the following statements about the ACID properties and/or the CAP theorem is **correct**?

- **A)** The D in the ACID properties stands for Durability, and it could be related with the P of the CAP theorem because they both describe the tolerance to partitioned transactions.
- **B)** The C in the CAP theorem stands for Consistency, and it states that (potentially) distributed replicas of a given data item appear always identical.
- **C)** The A in the CAP theorem stands for Atomicity, and it is less restrictive than the definition of the ACID Atomicity
- **D)** The C in the CAP theorem stands for Consistency, and it is equivalent to the definition of ACID Consistency

---

The following questions are related to the **Employees** database, reported in Appendix A.

The database can be used to manage the employment records of a company's employees. It includes tables for employees, departments, managers, salaries, and job titles.

Before answering the following questions: **analyze the database schema**, explore the properties of the tables, and understand how the tables relate to each other. Identify primary and foreign keys, and understand their constraints.

QUESTION 25. Which of the following statements best describes the result set produced by the following SQL query? Assume the query to run on a MySQL RDMS.

```
SELECT l.emp_no, dept_no, l.from_date, l.to_date
FROM dept_emp d INNER JOIN (
        SELECT emp_no, MAX(from_date) AS from_date, MAX(to_date) AS to_date
               FROM dept_emp
               GROUP BY emp_no ) AS l
        ON d.emp_no=l.emp_no
               AND d.from_date=l.from_date AND l.to_date = d.to_date;
```

A) The query is syntactically incorrect: it is not possible for an SQL sub-query defined in a FROM clause to contain a GROUP-BY operator.
B) For each employee in the database, the query returns the current department of employment, hiring date, and last day of employment
C) For each employee in the database, the query returns the first department of employment, hiring date, and last day of employment.
D) For each employee in the database that is currently employed, the query returns the current department of employment, hiring date, and last day of employment

QUESTION 26. Consider the query in QUESTION 25 and the SQL query below. Which of the following statements is correct? Assume the query to run on a MySQL RDMS.

```
SELECT l.emp_no, dept_no, l.from_date, l.to_date
FROM dept_emp d INNER JOIN (
        SELECT emp_no, MAX(from_date) AS from_date, MAX(to_date) AS to_date
        FROM dept_emp
        WHERE emp_no = d.emp_no ) AS l
        ON d.emp_no=l.emp_no
                AND d.from date=l.from date AND l.to date = d.to date;
```

A) The query in QUESTION 26 is syntactically incorrect: it is not possible for an SQL sub-query defined in a FROM clause to reference a column from another table defined in the same clause.
B) This query and the query in Question 25 are equivalent (they return the same result set) and their execution time is comparable.
C) The two queries are equivalent (they return the same result set), but the query in QUESTION 25 is faster because there are fewer comparisons to be performed by the JOIN clause.
D) The two queries are equivalent (they return the same result set), but the query in QUESTION 26 is faster because the condition in the WHERE clause of the subquery reduces the comparisons to be performed by the JOIN clause.

QUESTION 27. Consider the schema of the **Employees** database. Which of the following DML statements will cause a referential integrity constraint violation?

```
[1] DELETE FROM employees WHERE emp_no = '499999';
[2] DELETE FROM departments WHERE dept_no = 'd009';
[3] DELETE FROM dept_emp WHERE emp_no = '499999';
```

A) None
B) Only [1]
C) Only [1] and [2]
D) All

QUESTION 28. Consider the schema of the **Employees** database. Which of the following constraints **can** be enforced by a database implementing the schema? Assume no assertions or triggers are defined.

A) Every `Employee` must be employed in at least one `Department`.
B) An `Employee` cannot be employed in two `Departments` at the same time.
C) The value of the `to_date` attribute of the `dept_emp` table must be greater or equal to the value of the `from_date` attribute, for each instance in the table.
D) An `Employee` cannot be employed in a `Department` more than once.

QUESTION 29. Consider a database implementing the **Employees** schema. Which of the following statements best describes the effect the execution of the following SQL statement has on the database state?

```
UPDATE employees AS P
SET promotion = True
WHERE P.emp_no IN (
       SELECT emp_no FROM (
              SELECT emp_no, count(*) as total
              FROM dept_emp
              GROUP BY emp_no HAVING total > 1) AS i);
```

A) The database state will not change.
B) The database state will change because the statement updates the `promotion` attribute of the employees that changed their job more than once.
C) The database state will change because the statement creates the `promotion` attribute of the employees that changed their job more than once.
D) The database state will change because the statement sets the `promotion` attribute of the employees that changed their job.

QUESTION 30. Consider the following database schema and SQL query. Which answer best describes the meaning of the query? The attributes `ArtistName` and `SongTitle` of the `Performed` table are respectively foreign keys of the `Name` (`Artist`) and `Title` (`Song`) attributes.

```
Song (Title, Year, Genre, Lenght)
Performed (ArtistName, SongTitle)
Artist (Name, Nationality)
```

```
SELECT DISTINCT ArtistName
FROM Performed as P
WHERE SongTitle NOT IN (
              SELECT Title FROM Song
              WHERE Genre = 'Ska' AND Title IN (
                            SELECT SongTitle FROM Performed as P2
                            WHERE P2.ArtistName = P.ArtistName));
```

A) The query returns the artists that performed only songs that are not of genre "Ska".
B) The query returns the artists that performed at least one song that is not of genre "Ska".
C) The query returns the artists that performed only songs that are of genre "Ska".
D) The query returns the artists that performed at least one song that is of genre "Ska".

QUESTION 31. Consider the following database schema. Which of the following statements are correct? The attributes `WorkshopName` and `AutoLicense` of the `Repair` table are respectively foreign keys of the `WorkshopName` (`AutoWorkshop`) and `AutoLicense` (`Auto`) attributes.

```
AutoWorkshop (WorkshopName, Address, Director)
Repair (WorkshopName, ReceiptNumber, AutoLicense, Type, Date, Cost)
Auto (AutoLicense, Owner)
```

[1] Two `Repair` can have the same `ReceiptNumber`.
[2] The `Director` of an `AutoWorkshop` can be the `Owner` of an `Auto` repaired in his/her own `AutoWorkshop`.

A) None
B) Only [1]
C) Only [2]
D) Both

The following questions are related to the EER diagram depicted in Figure 2.

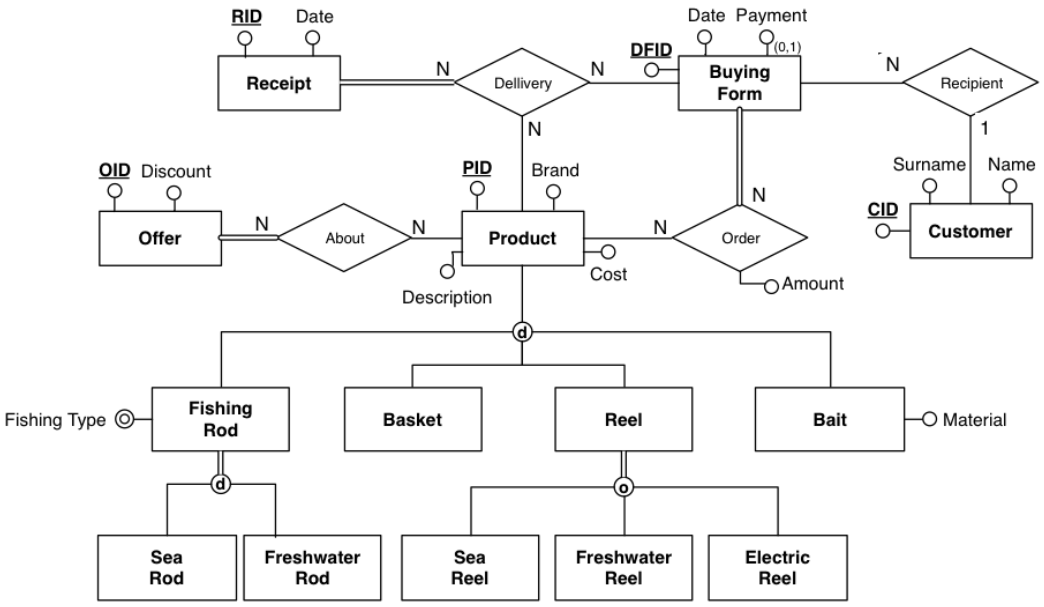

Figure 2 – EER Model #1

QUESTION 32 Which of the following statements does **correctly** describe the mini-world modelled by the EER diagram in Figure 2?

- **A)** A `Product` cannot be related with multiple `Offers`.
- **B)** A `Product` cannot be associated multiple times with the same `Buying Form`.
- **C)** Some instances of the `Reel` entity type are not instances of the `Sear Reel`, `Freshwater Reel`, or `Electric Reel` entity types.
- **D)** A `Basket` product can be ordered only with other `Basket` products.

QUESTION 33. Consider the diagram in Figure 2. Which of the following constraints is **not** expressed?

- **A)** An instance of the `Fishing Rod` entity type must be also an instance of either the `Sea Rod` entity type or the `Freshwater Rod` entity type.
- **B)** An instance of the `Offer` entity type must be associated to at least one instance of the `Product` entity type.
- **C)** An instance of the `Buying Form` entity type must be related to at most one instance of the `Customer` entity type.
- **D)** An instance of the `Product` entity type must be related to at least one instance of the `Buying Form` entity type.

QUESTION 34. Consider the diagram in Figure 2. Which of the following statements are **correct**?

[1] Due to multiple inheritance, an instance of the `Freshwater Rod` entity type includes the `Cost` attribute and the `Material` attribute.

[2] Due to multiple inheritance, an instance of the `Product` entity type must have at least one corresponding instance in one of the specialization entity types.

- **A)** None
- **B)** Only [1]
- **C)** Only [2]
- **D)** Both

QUESTION 35. Consider the following database schema, resulting from the partial transformation of the EER diagram depicted in Figure 2 into a relational model.

```
Product (PID, Brand, Description, Cost)
Fishing Rod (PID, Fishing Type)
Basket(PID)
Reel(PID)
Bait(PID,Material)
```

Which *specialization removal* restructuring strategy has been applied?

A) None
B) Parent Collapsing
C) Child Collapsing
D) Relationship Substitution

The following questions are related to the transformation of the EER diagram depicted in Figure 2 into a relational schema. The transformation is performed per the *standard* method described in the book in Chapter 8 and during lectures.

QUESTION 36. What is the minimum number of tables resulting from the transformation of the EER diagram in Figure 2 into a relational schema?

A) 8
B) 12
C) 17
D) 18

QUESTION 37. How many attributes in the table `Buying Form` will be allowed to assume `NULL` values in the resulting logical schema?

A) 0
B) 1
C) 2
D) 3

QUESTION 38. Which of the following statements about the transformation of the EER diagram in Figure 2 into a relational schema are **correct**?

[1] Every instance in the `Receipt` table will be associated with at least one instance in the `Buying Form` table.
[2] The relationship `Delivery` is transformed into a table having only the attributes `DFID` and `RID` as primary keys.

A) None
B) Only [1]
C) Only [2]
D) Both

The following questions are related to the EER diagram depicted in Figure 3.

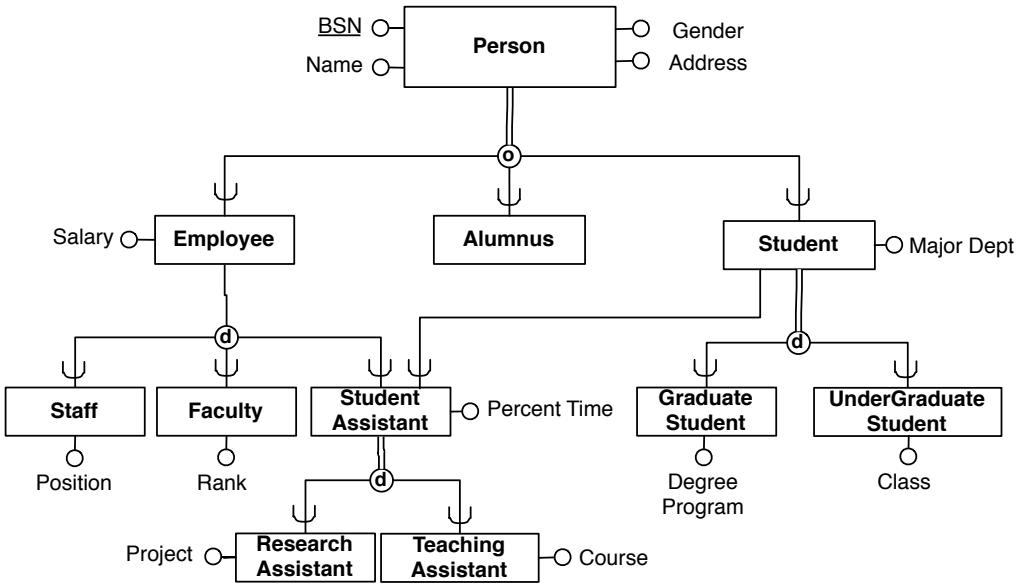

Figure 3 – EER Model #2

QUESTION 39. Which of the following constraints **is not expressed**?

- **A)** An instance of the `Student Assistant` entity type must also be an instance of the `Student` entity type.
- **B)** All instances of the `Student` entity type must be instances of the `Student Assistant` entity type.
- **C)** An instance of the `Research Assistant` entity type can be an instance of the `Alumnus` entity type.
- **D)** An instance of the `Student Assistant` entity type cannot be an instance of the `Faculty` entity type.

QUESTION 40. Consider the transformation of the EER diagram depicted in Figure 3 into a relational schema. The transformation is performed per the *standard* method described in the book in Chapter 8 and during lectures. How many attributes will compose the `Teaching Assistant` table?

- **A)** 1
- **B)** 7
- **C)** 8
- **D)** 12

Appendix A – Employees Database Schema

```
CREATE TABLE employees (
    emp_no      INT             NOT NULL,
    birth_date  DATE            NOT NULL,
    first_name  VARCHAR(14)     NOT NULL,
    last_name   VARCHAR(16)     NOT NULL,
    gender      ENUM ('M','F')  NOT NULL,
    hire_date   DATE            NOT NULL,
    PRIMARY KEY (emp_no)
);

CREATE TABLE departments (
    dept_no     CHAR(4)         NOT NULL,
    dept_name   VARCHAR(40)     NOT NULL,
    PRIMARY KEY (dept_no),
    UNIQUE  KEY (dept_name)
);

CREATE TABLE dept_manager (
   emp_no       INT             NOT NULL,
   dept_no      CHAR(4)         NOT NULL,
   from_date    DATE            NOT NULL,
   to_date      DATE            NOT NULL,  #Value set at 9999-01-01 for
                                           #current employment
   FOREIGN KEY (emp_no) REFERENCES employees (emp_no)ON DELETE CASCADE,
   FOREIGN KEY (dept_no) REFERENCES departments (dept_no)ON DELETE CASCADE,
   PRIMARY KEY (emp_no,dept_no)
);

CREATE TABLE dept_emp (
    emp_no      INT             NOT NULL,
    dept_no     CHAR(4)         NOT NULL,
    from_date   DATE            NOT NULL,
    to_date     DATE            NOT NULL,
    FOREIGN KEY (emp_no)  REFERENCES employees   (emp_no)  ON DELETE CASCADE,
    FOREIGN KEY (dept_no) REFERENCES departments (dept_no) ON DELETE CASCADE,
    PRIMARY KEY (emp_no,dept_no)
);

CREATE TABLE titles (
    emp_no      INT             NOT NULL,
    title       VARCHAR(50)     NOT NULL,
    from_date   DATE            NOT NULL,
    to_date     DATE,
    FOREIGN KEY (emp_no) REFERENCES employees (emp_no) ON DELETE CASCADE,
    PRIMARY KEY (emp_no,title, from_date)
);

CREATE TABLE salaries (
    emp_no      INT             NOT NULL,
    salary      INT             NOT NULL,
    from_date   DATE            NOT NULL,
    to_date     DATE            NOT NULL,
    FOREIGN KEY (emp_no) REFERENCES employees (emp_no) ON DELETE CASCADE,
    PRIMARY KEY (emp_no, from_date)
);
```