

CSC343 Worksheet 7 Solution

June 23, 2020

1. a)

```
1 void askUserForPrice() {
2     EXEC SQL BEGIN DECLARE SECTION;
3         int model;
4         float speed;
5         int ram;
6         int hd;
7         float price;
8         char maker;
9         float targetPrice;
10
11         float minDiff;
12         int modelSol;
13         float speedSol;
14         char makerSol;
15     EXEC SQL END DECLARE SECTION;
16
17     EXEC SQL DECLARE execCursor CURSOR FOR
18         SELECT * FROM Product NATURAL JOIN PC
19
20     EXEC SQL OPEN execCursor;
21
22     printf("Enter target price:");
23     scanf("%f", &targetPrice);
24
25     while(1) {
26         EXEC SQL FETCH FROM execCursor INTO :model,
27             :speed, :ram, :hd, :price, :maker;
28
29         if (NO_MORE_TUPLES) break;
30
31         if (abs(price - targetPrice) >= minDiff) {
32             continue;
33         }
34
35         minDiff = abs(price - targetPrice);
36         modelSol = model;
37         speedSol = speed;
38         makerSol = maker;
39     }
```

```
40
41     EXEC SQL CLOSE execCursor;
42
43     printf("maker=%c, model=%d, speed=%.2f\n", makerSol, modelSol
44           , speedSol);
45 }
46
```

Notes:

- EXEC SQL
 - Allows to use SQL statements within a host-language program
- The DECLARE Section
 - is used to declare shared variables
 - **Syntax:**
EXEC SQL BEGIN DECLARE SECTION;
... // Variable declarations in any language
EXEC SQL END DECLARE SECTION;

Example:

```
1     void getStudio() {
2         EXEC SQL BEGIN DECLARE SECTION;
3         char studioName[50], studioAddr[256]; // <- c
4         variables
5         char SQLSTATE[6];
6         EXEC SQL END DECLARE SECTION;
7
8         EXEC SQL INSERT INTO Studio(name, address)
9             VALUES (:studioName, :studioAddr);
10    }
```

- Cursors
 - Is the most versatile way to connect SQL queries
 - **Syntax:**
EXEC SQL DECLARE < cursor name > CURSOR FOR < query >

EXEC SQL OPEN < cursor name >;
...
EXEC SQL CLOSE < cursor name >;

Example:

```

1      void getStudio() {
2          EXEC SQL BEGIN DECLARE SECTION;
3              char studioName[50], studioAddr[256]; // <- c
variables
4              char SQLSTATE[6];
5          EXEC SQL END DECLARE SECTION;
6
7          EXEC SQL INSERT INTO Studio(name, address)
8              VALUES (:studioName, :studioAddr);
9      }
10

```

Example in Python:

```

1      import sqlite3
2      connection = sqlite3.connect("company.db")
3
4      cursor = connection.cursor()
5
6      staff_data = [ ("William", "Shakespeare", "m", "
1961-10-25"),
7                      ("Frank", "Schiller", "m", "1955-08-17"
8                      ),
9                      ("Jane", "Wall", "f", "1989-03-14") ]
10
11      for p in staff_data:
12          format_str = """INSERT INTO employee (staff_number,
13              fname, lname, gender, birth_date)
14              VALUES (NULL, "{first}", "{last}", "{gender}", "{
15              birthdate}");"""
16
17          sql_command = format_str.format(first=p[0], last=p
18          [1], gender=p[2], birthdate = p[3])
19          cursor.execute(sql_command)
20

```

- Fetch Statement

- fetch data from the result table one row at a time

- **Syntax:**

EXEC SQL FETCH FROM < cursor name > INTO < list of variables >

Example:

```

1      void worthRanges() {
2          int i, digits, counts[15];
3          EXEC SQL BEGIN DECLARE SECTION;
4              int worth;
5              char SQLSTATE[6];
6          EXEC SQL END DECLARE SECTION;
7          EXEC SQL DECLARE execCursor CURSOR FOR
8              SELECT netWorth FROM MovieExec;
9

```

```

9
10         EXEC SQL OPEN execCursor;
11         for (i=1; i < 15; i++) counts[i] = 0;
12         while(1) {
13             EXEC SQL FETCH FROM execCursor INTO :worth; //
fetches a row of value from movieExec and stores in worth
14             if (NO_MORE_TUPLES) break;
15
16             ...
17         }
18     }
19

```

b)

```

2     void findLaptops() {
3         EXEC SQL BEGIN DECLARE SECTION;
4         int model;
5         float speed;
6         int ram;
7         int hd;
8         int screen;
9         float price;
10
11         float minSpeed;
12         int minRam;
13         int minHd;
14         float minPrice;
15     EXEC SQL END DECLARE SECTION;
16
17     EXEC SQL DECLARE execCursor CURSOR FOR
18         SELECT model, speed, ram, hd, screen, price, maker
19         FROM Product NATURAL JOIN Laptop;
20
21     EXEC SQL OPEN execCursor;
22
23     printf("Enter minimum speed:");
24     scanf("%f", &minSpeed);
25
26     printf("Enter minimum ram:");
27     scanf("%f", &minRam);
28
29     printf("Enter minimum hard-drive space:");
30     scanf("%f", &minHd);
31
32     printf("Enter minimum price:");
33     scanf("%f", &minPrice);
34
35     while(1) {
36         EXEC SQL FETCH FROM execCursor INTO :model,
37             :speed, :ram, :hd, :screen, :price, :maker;
38
39         if (NO_MORE_TUPLES) break;
40
41         if (
            speed >= minSpeed &&

```

```

42         ram >= minRam &&
43         hd >= minHd &&
44         screen >= minScreen
45     ) {
46         printf("model=%d, speed=%.2f, ram=%d, hd=%d, screen=%d, price=%.2f, maker=%c",
47             model, speed, ram, hd, screen, price, maker);
48     }
49 }
50
51 EXEC SQL CLOSE execCursor;
52 }
53

```

```

c) #include <stdbool.h>
2  #include <string.h>
3  ...
4  void printSpecifications() {
5      EXEC SQL BEGIN DECLARE SECTION;
6          int model;
7          bool color;
8          char printType[50];
9          float price;
10
11         float speed;
12         int ram;
13         int hd;
14         int screen;
15
16         char maker;
17         int productModel;
18         char productType[50];
19
20         char targetMaker;
21     EXEC SQL END DECLARE SECTION;
22
23     EXEC SQL DECLARE execCursor CURSOR FOR
24         SELECT DISTINCT maker, DISTINCT productType FROM Product;
25
26     printf("Enter manufacturer:");
27     scanf("%c", &targetMaker);
28
29     EXEC SQL OPEN execCursor;
30     while (1) {
31         EXEC SQL FETCH FROM execCursor INTO :maker, :productType;
32
33         if (NO_MORE_TUPLES) break;
34
35         if (tolower(maker) != tolower(targetMaker)) continue;
36
37         if (strcmp(productType, 'pc')) {
38             EXEC SQL DECLARE pcCursor CURSOR FOR
39                 SELECT speed, ram, hd, price FROM PC
40                 NATURAL JOIN Product

```

```

41         WHERE type=productType;
42
43     EXEC SQL OPEN pcCursor;
44     while(1) {
45         EXEC SQL FETCH FROM pcCursor INTO :speed,
46             :ram, :hd, :price;
47
48         if (NO_MORE_TUPLES) break;
49
50         printf("model=%d, speed=%.2f, ram=%d, hd=%d,
51 price=%.2f, maker=%c, type=%s",
52             model, speed, ram, hd, screen, price, maker,
53 productType);
54     }
55     EXEC SQL CLOSE pcCursor;
56
57 } else if (strcmp(productType, 'laptop')) {
58
59     EXEC SQL DECLARE laptopCursor CURSOR FOR
60     SELECT speed, ram, hd, screen, price FROM Laptop
61     NATURAL JOIN Product
62     WHERE type=productType;
63
64     EXEC SQL OPEN laptopCursor;
65     while(1) {
66         EXEC SQL FETCH FROM laptopCursor INTO :speed,
67             :ram, :hd, :screen, :price;
68
69         if (NO_MORE_TUPLES) break;
70
71         printf("model=%d, speed=%.2f, ram=%d, hd=%d,
72 screen=%d, price=%.2f, maker=%c, type=%s",
73             model, speed, ram, hd, screen, screen, price,
74 maker, productType);
75     }
76     EXEC SQL CLOSE laptopCursor;
77
78 } else if (strcmp(productType, 'printer')) {
79
80     EXEC SQL DECLARE printerCursor CURSOR FOR
81     SELECT color, printType, price FROM Printer
82     NATURAL JOIN Product
83     WHERE type=productType;
84
85     EXEC SQL OPEN printerCursor;
86     while(1) {
87         EXEC SQL FETCH FROM printerCursor INTO :color,
88             :printType, :price;
89
90         if (NO_MORE_TUPLES) break;
91
92         printf("model=%d, color=%s, price=%.2f, maker=%c,
93 type=%s",
94             model, color ? "true" : "false", price, maker,

```

```

type);
90         }
91         EXEC SQL CLOSE printerCursor;
92     }
93 }
94 EXEC SQL CLOSE execCursor;
95 }
96

```

Correct Solution:

```

1  #include <stdbool.h>
2  #include <string.h>
3  ...
4  void printSpecifications() {
5      EXEC SQL BEGIN DECLARE SECTION;
6          int model;
7          bool color;
8          char printType[50];
9          float price;
10
11         float speed;
12         int ram;
13         int hd;
14         int screen;
15
16         char maker;
17         int productModel;
18         char productType[50];
19
20         char targetMaker;
21     EXEC SQL END DECLARE SECTION;
22
23     EXEC SQL DECLARE execCursor CURSOR FOR
24         SELECT maker, productType FROM Product
25         GROUP BY maker, productType; // <- Correction
26
27     printf("Enter manufacturer:");
28     scanf("%c", &targetMaker);
29
30     EXEC SQL OPEN execCursor;
31     while (1) {
32         EXEC SQL FETCH FROM execCursor INTO :maker, :
productType;
33
34         if (NO_MORE_TUPLES) break;
35
36         if (tolower(maker) != tolower(targetMaker)) continue;
37
38         if (strcmp(productType, 'pc')) {
39             EXEC SQL DECLARE pcCursor CURSOR FOR

```

```

40         SELECT speed, ram, hd, price FROM PC
41         NATURAL JOIN Product
42         WHERE type=productType;
43
44     EXEC SQL OPEN pcCursor;
45     while(1) {
46         EXEC SQL FETCH FROM pcCursor INTO :speed,
47             :ram, :hd, :price;
48
49         if (NO_MORE_TUPLES) break;
50
51         printf("model=%d, speed=%.2f, ram=%d, hd=%d,
52 price=%.2f, maker=%c, type=%s",
53             model, speed, ram, hd, screen, price, maker,
54 productType);
55     }
56     EXEC SQL CLOSE pcCursor;
57
58     } else if (strcmp(productType, 'laptop')) {
59
60         EXEC SQL DECLARE laptopCursor CURSOR FOR
61             SELECT speed, ram, hd, screen, price FROM
62 Laptop
63             NATURAL JOIN Product
64             WHERE type=productType;
65
66         EXEC SQL OPEN laptopCursor;
67         while(1) {
68             EXEC SQL FETCH FROM laptopCursor INTO :speed,
69                 :ram, :hd, :screen, :price;
70
71             if (NO_MORE_TUPLES) break;
72
73             printf("model=%d, speed=%.2f, ram=%d, hd=%d,
74 screen=%d, price=%.2f, maker=%c, type=%s",
75                 model, speed, ram, hd, screen, screen, price,
76 maker, productType);
77         }
78         EXEC SQL CLOSE laptopCursor;
79
80     } else if (strcmp(productType, 'printer')) {
81         EXEC SQL DECLARE printerCursor CURSOR FOR
82             SELECT color, printType, price FROM Printer
83             NATURAL JOIN Product
84             WHERE type=productType;
85
86         EXEC SQL OPEN printerCursor;
87         while(1) {
88             EXEC SQL FETCH FROM printerCursor INTO :color,
89                 :printType, :price;
90
91             if (NO_MORE_TUPLES) break;

```



```

88         printf("model=%d, color=%s, price=%.2f, maker
89         =%c, type=%s",
90         model, color ? "true" : "false", price, maker,
91         type);
92     }
93     EXEC SQL CLOSE printerCursor;
94 }
95 EXEC SQL CLOSE execCursor;
96 }
97

```

d)

e)

```

1 #include <stdbool.h>
2 #include <string.h>
3 ...
4 void insertNewPC() {
5     EXEC SQL BEGIN DECLARE SECTION;
6         int model;
7         float speed;
8         int ram;
9         int hd;
10        float price;
11        char maker;
12
13        int modelCount;
14    EXEC SQL END DECLARE SECTION;
15
16    printf("Enter manufacturer:\n");
17    scanf("%c", &maker);
18
19    printf("Enter model:\n");
20    scanf("%d", &model);
21
22    printf("Enter speed:\n");
23    scanf("%f", &speed);
24
25    printf("Enter ram:\n");
26    scanf("%d", &ram);
27
28    printf("Enter hd:\n");
29    scanf("%d", &hd);
30
31    printf("Enter price:\n");
32    scanf("%f", &price);
33
34    printf("Enter maker:\n");
35    scanf("%c", &maker);
36
37    EXEC SQL DECLARE execCursor CURSOR FOR
38        SELECT COUNT(model) FROM (
39            (SELECT model FROM Product WHERE model=:model)

```

```

40         UNION
41         (SELECT model FROM PC WHERE model=:model)
42     );
43
44     EXEC SQL OPEN execCursor;
45     EXEC SQL FETCH FROM execCursor INTO :modelCount;
46
47     if (modelCount != 0) {
48         printf("Error. Model already exists in database.");
49     } else {
50         EXEC SQL INSERT INTO PC(model, speed, ram, hd, price)
51             VALUES(:model, :speed, :ram, :hd, :
price);
52
53         EXEC SQL INSERT INTO Product(model, maker, type)
54             VALUES(:model, :maker, "pc")
55     }
56
57
58     EXEC SQL CLOSE execCursor;
59 }
60

```

2. a)

```

    void classWithLargestPower() {
2        EXEC SQL BEGIN DECLARE SECTION;
3        int class;
4        EXEC SQL END DECLARE SECTION;
5
6        EXEC SQL SELECT class FROM FROM Classes
7            INTO :class
8            WHERE numGuns * POWER(bore, 3) >= ALL (
9                SELECT numGuns * POWER(bore, 3) FROM Classes
10            );
11
12        printf("Class = %s\n", class);
13    }
14

```

b)

```

#include <string.h>
2    ...
3    void countryWithMostShipsSunk() {
4        EXEC SQL BEGIN DECLARE SECTION;
5        char targetBattle[255];
6        char country[100];
7        int count;
8
9        char mostSunkCountry[100];
10       int maxSunkCount = 0;
11
12       char mostDamagedCountry[100];
13       int maxDamagedCount = 0;
14
15       EXEC SQL END DECLARE SECTION;

```

```
16
17     printf("Enter name of battle:\n");
18     scanf("%s", &targetBattle);
19
20     EXEC SQL DECLARE shipsSunkCursor CURSOR FOR
21         SELECT country, COUNT(Outcomes.result) FROM Classes
22         INNER JOIN Ships ON Classes.class = Ships.class
23         INNER JOIN Outcomes ON Ships.name = Outcomes.ship
24         INNER JOIN Battles ON Battles.name = Outcome.battle
25         GROUP BY country
26         HAVING Battles.name=:targetBattle;
27         Outcomes.result='sunk';
28
29     EXEC SQL DECLARE shipsDamagedCursor CURSOR FOR
30         SELECT country, COUNT(Outcomes.result) FROM Classes
31         INNER JOIN Ships ON Classes.class = Ships.class
32         INNER JOIN Outcomes ON Ships.name = Outcomes.ship
33         INNER JOIN Battles ON Battles.name = Outcome.battle
34         GROUP BY country
35         HAVING Battles.name=:targetBattle;
36         Outcomes.result='damaged';
37
38     EXEC SQL OPEN shipsSunkCursor;
39     while(1) {
40         EXEC SQL FETCH FROM shipsSunkCursor INTO :country,
41         :count;
42
43         if (NO_MORE_TUPLES) break;
44
45         if (count > maxSunkCount) {
46             maxSunkCount = count;
47             strcpy(mostSunkCountry, country);
48         }
49     }
50
51     printf("Country with most sunk ships: %s",
52     mostSunkCountry);
53
54     EXEC SQL CLOSE shipsSunkCursor;
55
56     EXEC SQL OPEN shipsDamagedCursor;
57     while(1) {
58         EXEC SQL FETCH FROM shipsDamagedCursor INTO :country,
59         :count;
60
61         if (NO_MORE_TUPLES) break;
62
63         if (count > maxDamagedCount) {
64             maxDamagedCount = count;
65             strcpy(mostDamagedCountry, country);
66         }
67     }
68
69     printf("Country with most damaged ships: %s",
```

```

68     mostDamagedCountry);
69
70     EXEC SQL CLOSE shipsDamagedCursor;
71
72 }
73

```

```

c) #define NO_MORE_TUPLES ! (strcmp(SQLSTATE, "02000"));
2
3 void insertClassAndShip() {
4     EXEC SQL BEGIN DECLARE SECTION;
5         char class[100];
6         char type[2];
7         char country[100];
8         int numGuns;
9         int bore;
10        int displacement;
11
12        char shipName[100];
13        char dateLaunched[11];
14
15        char SQLSTATE[6];
16    EXEC SQL END DECLARE SECTION;
17
18    printf("Enter name of class:\n");
19    scanf("%s", class);
20
21    printf("Enter name of type ('bb' or 'bc'):\n");
22    scanf("%s", type);
23
24    printf("Enter name of country:\n");
25    scanf("%s", country);
26
27    printf("Enter name of numGuns:\n");
28    scanf("%d", &numGuns);
29
30    printf("Enter name of bore:\n");
31    scanf("%d", &bore);
32
33    printf("Enter name of displacement:\n");
34    scanf("%d", &displacement);
35
36    printf("Enter name of ship (if first ship, skip by pressing
ENTER):\n");
37    fgets(shipName, sizeof shipName, stdin);
38
39    if (shipName[0] == '\n') {
40        strncpy(shipName, class, sizeof(class));
41    }
42
43    printf("Enter date launched (YYYY-MM-DD):\n");
44    scanf("%s", dateLaunched);
45
46    EXEC SQL INSERT INTO Classes(class, type, country, numGuns,

```

```

47     bore, displacement)
48         VALUES (:class, :type, :country, :numGuns, :bore, :
49     displacement);
50
51     EXEC SQL INSERT INTO Ships(name, class, launched)
52         VALUES (:shipName, :class, :dateLaunched);
53 }

```

```

d) #define NO_MORE_TUPLES ! (strcmp(SQLSTATE, "02000"));
2
3 void correctError() {
4     EXEC SQL BEGIN DECLARE SECTION;
5     char battle[101];
6     char shipName[101];
7     char dateLaunched[11];
8     char newDateLaunched[11];
9
10    char dateBattle[11];
11    char newDateBattle[11];
12
13    char SQLSTATE[6];
14    EXEC SQL END DECLARE SECTION;
15
16    EXEC SQL DECLARE execCursor CURSOR FOR
17        SELECT Ships.name,
18               Ships.class,
19               Ships.launched,
20               Outcomes.battle,
21               Battles.date
22    FROM Ships
23    INNER JOIN Outcomes ON Ships.name = Outcomes.ship
24    INNER JOIN Battles ON Outcomes.battle = Battles.name
25    WHERE Ships.launched > Battles.date;
26
27    EXEC SQL OPEN execCursor;
28    while(1) {
29        EXEC SQL FETCH FROM execCursor INTO :shipName,
30            :class, :dateLaunched, :battle, :dateBattle;
31
32        if (NO_MORE_TUPLES) break;
33
34        printf("Error. Ship %s is launched after date of
35    battle.\n");
36
37        printf("Enter correct launched date (YYYY-MM-DD,
38    Press enter to skip):\n");
39        fgets(dateLaunched, sizeof(dateLaunched), stdin);
40
41        if (dateLaunched[0] != '\n') {
42            // Correct date of launch
43            EXEC SQL UPDATE Ships
44                SET launched = newDateLaunched
45                WHERE name=:shipName AND

```

```

44         class=:class AND
45         launched=:dateLaunched;
46     }
47
48     printf("Enter correct battle date (YYYY-MM-DD, Press
49 enter to skip):\n");
50     fgets(dateBattle, sizeof(dateBattle), stdin);
51
52     if (dateBattle[0] != '\n') {
53         // Correct date of battle
54         EXEC SQL UPDATE Battles
55             SET date = newDateBattle
56             WHERE name=:battle AND
57                 date=dateBattle;
58     }
59     EXEC SQL CLOSE execCursor;
60
61 }
62

```

3. a)

```

2  CREATE FUNCTION getNetWorth(studioName CHAR(15)) RETURN INTEGER
3
4  BEGIN
5      DECLARE presNetWorth INTEGER;
6      SET presNetWorth = (
7          SELECT netWorth FROM Studio INNER JOIN MovieExec
8          ON Studio.presC# = MovieExec.cert#
9          WHERE Studio.name = :studioName;
10
11      );
12      RETURN presNetWorth;
13  END;

```

Notes:

- PSM

- Is also called **Persistent, Stored Modules**
- Is very similar to function
 - * Procedure → void function
 - * Function → non-void function
- **Syntax:**

```

CREATE PROCEDURE < name > (< parameters >)
< local declarations >
< syntax body >;

```

– **Syntax # 2:**

CREATE FUNCTION < name > (< parameters list >) RETURNS < type >
 < local declarations >
 < syntax body >;

Example:

```

1      CREATE PROCEDURE Move(
2          IN oldAddr VARCHAR(255),
3          IN newAddr VARCHAR(255)
4      )
5      UPDATE MovieStar
6      SET address = newAddr
7      WHERE address = oldAddr;
8  
```

• List of simple PSM statements

1. Call-statement

- **Syntax:** CALL < procedure name > (< argument list >)
- is used to invoke procedure
- is included in function

Example:

```

1      EXEC SQL CALL Foo(:x, 3)
2  
```

2. Return-statement

- **Syntax:** RETURN < expression >
- can only be appeared in function
- evaluates the expression and sets the return-value of the function equivalent of the result

Example:

```

1      CREATE FUNCTION BandW(y INT, s CHAR(15)) RETURN BOOLEAN
2
3      ...
4
5      THEN RETURN TRUE;
6      ELSE RETURN FALSE;
7
8      END IF;
9  
```

3. Declarations of local variables

- **Syntax:** DECLARE < name > < type >

- Is used to declare a variable
- Is not preserved by DBMS after a running of the function or procedure
- Must precede executable statements

Example:

```

1  CREATE PROCEDURE SomeProc(IN studioName CHAR(15))
2
3  DECLARE presNetWorth INTEGER;
4

```

4. Assignment statements

- **Syntax:** SET < variable > = < expression >
- Is quite like assignment in other languages.
- The expression can be a query as long as it returns a single value

Example:

```

1  CREATE PROCEDURE MeanVar(
2      IN s CHAR(15),
3      OUT mean REAL,
4      OUT variance REAL
5  )
6
7  BEGIN
8      ...
9      SET mean=0.0;
10     ...
11     SET movieCount = (SELECT COUNT(name) FROM Movies);
12     SET mean= mean / movieCount;
13     END
14

```

5. Statement groups

- **Syntax:** BEGIN ... END
- Is used to envelope function body in Procedures and Functions
- is like *function*{ } used in functions (i.e. javascript, c, java)

Example:

```

1  CREATE PROCEDURE MeanVar (
2      IN s CHAR(15),
3      OUT mean REAL,
4      OUT variance REAL
5  )
6
7  BEGIN
8      ...
9  END;
10

```


- IF ELSE

- **Syntax:**

```

IF < condition > THEN
  < statement list >
ELSEIF < condition > THEN
  < statement list >
ELSEIF
...
ELSE
  < statement list >
END IF;

```

Example:

```

1  CREATE FUNCTION BandW(y INT, s CHAR(15)) RETURNS BOOLEAN
2
3  BEGIN
4  IF NOT EXISTS(
5      SELECT * FROM Movies WHERE year = y AND
6      studioName = s)
7
8  THEN RETURN TRUE;
9  ELSEIF 1 <=
10     (SELECT COUNT(*) FROM Movies WHERE year = y AND
11     studioName = s AND genre = 'comedy')
12
13  THEN RETURN TRUE;
14  ELSE RETURN FALSE;
15  END IF;
16  END;
17

```

- Loops in PSM

- Is used with cursor
 - exists a break statement for loop (i.e. LEAVE < loop label >)
 - **Syntax:**

```

LOOP
  < statement list >
END LOOP;

```

Example:

```

1  CREATE PROCEDURE MeanVar(
2      IN s CHAR(15),
3      OUT mean REAL,
4      OUT variance REAL

```

```

5      )
6
7      BEGIN
8          ...
9          movieLoop: LOOP
10             FETCH FROM MovieCursor INTO newLength;
11             IF Not_Found THEN LEAVE movieLoop END IF;
12             SET movieCount = movieCount + 1;
13             SET mean = mean + newLength;
14             ...
15         END LOOP
16
17     END;
18

```

- For-loops

- is also used to iterate over cursor

- **Syntax:**

```

FOR < loop name > AS < cursor name > CURSOR FOR
< query >
DO
< statement list >
END FOR;

```

Example:

```

1      CREATE PROCEDURE MeanVar(
2          IN s CHAR(15),
3          OUT mean REAL,
4          OUT variance REAL
5      )
6
7      BEGIN
8          ...
9          FOR movieLoop AS MovieCursor CURSOR FOR
10             SELECT length FROM Movies WHERE studioName = s;
11          DO
12             FETCH FROM MovieCursor INTO newLength;
13             IF Not_Found THEN LEAVE movieLoop END IF;
14             SET movieCount = movieCount + 1;
15             SET mean = mean + length;
16             SET variance = mean + length * length;
17             ...
18         END LOOP
19
20     END;
21

```

- Exceptions in PSM

- **Syntax:**

DECLARE < where to go next > HANDLER FOR < condition list >
< statement >

– Choices for where to go

1. CONTINUE

* Continues to execute code as is

2. EXIT

* Leaves BEGIN ... END block

3. UNDO

* In addition to EXIT, any changes made to database is undone

Example:

```

1  CREATE FUNCTION GetYear(t VARCHAR(255)) RETURN INTEGER
2
3  DECLARE Not_Found CONDITION FOR SQLSTATE '02000';
4  DECLARE Too_Many CONDITION FOR SQLSTATE '21000';
5
6  BEGIN
7      DECLARE EXIT HANDLER FOR Not_Found, Too_Many
8          RETURN NULL;
9      RETURN (SELECT year FROM Movies WHERE title = t);
10 END;
11

```

• Using PSM Functions and Procedures

- Always include CALL before Procedures
- Can be used in WHERE

Example:

```

1  INSERT INTO StarsIn(movieTitle, movieYear, starName)
2  VALUES ('Remember the Titans', GetYear('Remember the Titans
3  '),
4          'Denzel Washington');

```

b)

```

1  CREATE FUNCTION GetPersonType(name CHAR(50), address VARCHAR(255)
2  ) RETURN INTEGER
3
4  BEGIN
5      DECLARE type INTEGER;
6
7      IF NOT EXISTS (
8          SELECT * FROM MovieStar
9          WHERE name=name AND
10             address=address
11      ) AND EXISTS (
12          SELECT * FROM MovieExec

```

```

12         WHERE name=name AND
13             address=address
14     )
15
16     THEN RETURN 1;
17
18     ELSEIF EXISTS (
19         SELECT * FROM MovieStar
20         WHERE name=name AND
21             address=address
22     ) AND NOT EXISTS (
23         SELECT * FROM MovieExec
24         WHERE name=name AND
25             address=address
26     )
27
28     THEN RETURN 2;
29
30     ELSEIF EXISTS (
31         SELECT * FROM MovieStar NATURAL JOIN MovieExec
32         WHERE name=name AND
33             address=address
34     )
35
36     THEN RETURN 3;
37
38     ELSE RETURN 4;
39
40 END;
41

```

c)

```

1  CREATE PROCEDURE getTwoLongest(
2      IN studioName CHAR(50)
3  )
4
5      DECLARE firstMovieTitle CHAR(100);
6      DECLARE secondMovieTitle CHAR(100);
7
8      BEGIN
9          SET movieCount = 1;
10         SET firstMovieTitle = NULL;
11         SET secondMovieTitle = NULL;
12
13         FOR movieLoop as MovieCursor FOR
14             SELECT title FROM Movies
15             ORDER BY length DESC
16             WHERE studioName=studioName
17             LIMIT 2;
18         DO
19             IF movieCount = 1
20                 THEN SET firstMovieTitle = title;
21             ELSEIF movieCount = 2
22                 THEN SET secondMovieTitle = title;
23             END IF;

```

```
24
25         SET movieCount = movieCount + 1;
26     END FOR;
27 END;
28
```

d)

```
CREATE FUNCTION getEarliestMovieOver120(
2     starName CHAR(100)
3 ) RETURN INTEGER
4
5 BEGIN
6     SET year = 0;
7
8     IF EXISTS (
9         SELECT movieYear FROM Movies
10        INNER JOIN StarsIn ON Movies.title = StarsIn.movieTitle
11        ORDER BY year ASC
12        WHERE length >= 120 AND
13              starName = starName
14        LIMIT 1;
15    ) THEN
16        SET year = movieYear;
17    END IF;
18    RETURN year;
19 END;
20
21
```

e)

```
CREATE FUNCTION getUniqueStarWithAddress(
2     address CHAR(255)
3 ) RETURNS CHAR(100)
4
5 BEGIN
6
7     SET uniqueStarName = NULL;
8     SET starCount = 1;
9
10    FOR movieStarLoop AS MovieStarCursor CURSOR FOR
11        SELECT starName FROM MovieStar
12        WHERE address=address;
13
14        IF starCount > 1
15        THEN RETURN NULL;
16
17        ELSE SET uniqueStarName = starName;
18
19        END IF;
20
21        SET starCount = starCount + 1;
22    END FOR;
23
24    RETURN uniqueStarName;
25 END;
26
```

27

```

f) CREATE PROCEDURE deleteStar(
    2     starName CHAR(100)
    3 )
    4
    5 BEGIN
    6
    7 FOR MovieLoop AS MovieCursor CURSOR FOR
    8     SELECT movieTitle FROM StarIn
    9     WHERE starName = starName;
10 DO
11     DELETE FROM Movies
12     WHERE title=movieTitle;
13 END FOR;
14
15 DELETE FROM StarIn
16 WHERE starName=starName;
17
18 DELETE FROM MovieStar
19 WHERE name=starName;
20
21 END;
22
23

```

```

4. a) CREATE FUNCTION getClosestPrice(
    2     targetPrice FLOAT
    3 )
    4
    5 BEGIN
    6
    7 SET model = (
    8     SELECT model FROM PC
    9     WHERE model IN (
10         SELECT model, ABS(price - targetPrice) AS priceDiff FROM
PC
11
12         ORDER BY priceDiff ASC
13         LIMIT 1;
14     )
15 );
16
17 return model;
18
19 END;
20
21

```

```

b) CREATE FUNCTION getProductType(
    2     maker CHAR(1),
    3     model INTEGER
    4 )

```

```

5
6 BEGIN
7 SET price = (
8     SELECT price FROM (
9         (SELECT model, price FROM Product NATURAL JOIN PC)
10        UNION
11        (SELECT model, price FROM Product NATURAL JOIN Laptop)
12        UNION
13        (SELECT model, price FROM Product NATURAL JOIN Printer)
14    )
15    WHERE model=model
16 );
17
18 RETURN price;
19 END;
20
21

```

```

c) CREATE PROCEDURE insertNewPC(
2     IN insertModel INTEGER,
3     IN insertSpeed FLOAT,
4     IN insertRam INTEGER,
5     IN insertHd INTEGER,
6     IN insertPrice FLOAT
7 )
8
9 DECLARE Already_Exists CONDITION FOR SQLSTATE '23000';
10
11 BEGIN
12
13     WHILE 1=1 DO
14
15         INSERT INTO PC(model, speed, ram, hd, price)
16         VALUES (insertModel, insertSpeed, insertRam, insertHd,
insertPrice);
17         IF NOT Already_Exists
18         THEN break;
19         END IF;
20
21         SET insertModel = insertModel + 1;
22
23     END WHILE;
24 END;
25
26

```

Notes:

- SQL Server does not have true and false values. Use pseudo true instead (i.e. 1=1)
[1]

References:

1) StackOverflow: SQL Server - boolean literal?, link

```
d) CREATE PROCEDURE getHigherPricedProducts(  
2     IN targetPrice FLOAT,  
3     OUT pcCount INTEGER,  
4     OUT laptopCount INTEGER,  
5     OUT printerCount INTEGER  
6 )  
7  
8 BEGIN  
9     SET pcCount = (SELECT COUNT(model) FROM PC  
10    NATURAL JOIN Product  
11    GROUP BY type  
12    HAVING price > targetPrice);  
13  
14    SET laptopCount = (SELECT COUNT(model) FROM Laptop  
15    NATURAL JOIN Product  
16    GROUP BY type  
17    HAVING price > targetPrice);  
18  
19    SET printerCount = (SELECT COUNT(model) FROM Printer  
20    NATURAL JOIN Product  
21    GROUP BY type  
22    HAVING price > targetPrice);  
23 END;  
24
```

```
5. a) CREATE PROCEDURE getFirePower(  
2     IN targetClass CHAR(100),  
3     OUT firePower INTEGER,  
4 )  
5  
6 BEGIN  
7     SET firePower = (  
8     SELECT numGuns * POWER(bore, 3) FROM Classes  
9     WHERE class=targetClass;  
10    );  
11 END;  
12
```

```
b) CREATE PROCEDURE getFirePower(  
2     IN targetClass CHAR(100),  
3     OUT firePower INTEGER,  
4 )  
5  
6 BEGIN  
7     SET firePower = (  
8     SELECT numGuns * POWER(bore, 3) FROM Classes  
9     WHERE class=targetClass;  
10    );  
11 END;  
12
```



```
c) CREATE PROCEDURE getTwoCountriesInBattle(  
2     IN targetBattle CHAR(100),  
3     OUT firstCountry CHAR(100),  
4     OUT secondCountry CHAR(100)  
5 )  
6  
7 BEGIN  
8     SET countryCount = 1;  
9     SET firstCountry = NULL;  
10    SET secondCountry = NULL;  
11  
12    FOR battleLoop as BattleCursor FOR  
13        SELECT country FROM Classes  
14        INNER JOIN Ships ON Classes.class = Ships.class  
15        INNER JOIN Outcomes ON Outcomes.ship = Ships.name  
16        WHERE Outcomes.battle=targetBattle;  
17    DO  
18        IF countryCount = 1  
19            THEN SET firstCountry = country;  
20        ELSEIF countryCount = 2  
21            THEN SET secondCountry = country;  
22        ELSE  
23            BEGIN  
24                SET firstCountry = NULL;  
25                SET secondCountry = NULL;  
26                LEAVE battleLoop;  
27            END  
28        END IF;  
29    END FOR;  
30 END;  
31
```

```
d) CREATE PROCEDURE insertShipAndClass(  
2     IN inputClass CHAR(100),  
3     IN type CHAR(2),  
4     IN country CHAR(100),  
5     IN numGuns INTEGER,  
6     IN bore INTEGER,  
7     IN displacement INTEGER  
8 )  
9 BEGIN  
10  
11 END;  
12
```