

# 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
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

```

- 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             NATURAL JOIN Product
63             WHERE type=productType;
64
65         EXEC SQL OPEN laptopCursor;
66         while(1) {
67             EXEC SQL FETCH FROM laptopCursor INTO :speed,
68                 :ram, :hd, :screen, :price;
69
70             if (NO_MORE_TUPLES) break;
71
72             printf("model=%d, speed=%.2f, ram=%d, hd=%d,
73 screen=%d, price=%.2f, maker=%c, type=%s",
74                 model, speed, ram, hd, screen, screen, price,
75 maker, productType);
76         }
77         EXEC SQL CLOSE laptopCursor;
78
79     } else if (strcmp(productType, 'printer')) {
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;

```



```

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) #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     EXEC SQL INSERT INTO Ships(name, class, launched)
51         VALUES (:shipName, :class, :dateLaunched);
52 }

```

```

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
battle.\n");
35
36        printf("Enter correct launched date (YYYY-MM-DD,
Press enter to skip):\n");
37        fgets(dateLaunched, sizeof(dateLaunched), stdin);
38
39        if (dateLaunched[0] != '\n') {
40            // Correct date of launch
41            EXEC SQL UPDATE Ships
42                SET launched = newDateLaunched
43                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)

```

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

```

e)

```

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

```

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
```