Week-4, Practice Assignment

Question-1 [2 Marks]

Statement

For which of the following situation(s) is/are a nested loop needed? It is a Multiple Select Question (MSQ).

Options

(a)

To find the pair of students who have the same birthdays from the "Scores" dataset

(b)

To find the pair of students who scored the same marks in Physics from the "Scores" dataset

(c)

To find the number of words which have highest letter count from the "Words" dataset

(d)

To find the number of bills from the same shop from the "Shopping Bills" dataset

Answer

(a), (b)

Solution

In the above question we have to find the situations where nested loop is required. Therefore we will go through the each options.

Option a): We need a nested loop for finding the pair of students who have the same birthdays. The outer loop (while) will select a card from the dataset and the inner loop (while) will compare this card with the remaining cards in the dataset for the same birthday. The pseudocode can be:

```
1   count = 0
2   while(Table 1 has more rows) {
3       Read the top row X from the Table 1
4       Move X to the Table 2
5       while (Table 1 has more rows) {
6           Read the top row Y from the Table 1
7           if (X.DateOfBirth == Y.DateOfBirth) {
8               count = count + 1
9           }
10          Move Y to Table 3
11      }
12      Move all rows from Table 3 to Table 1
13  }
```

Option b): In this situation we also need a nested loop for finding the pair of students who scored same marks in Physics. The outer loop (while) will select a card from the dataset and the inner loop (while) will compare this card with the remaining cards in the dataset for the same marks in Physics. The pseudocode can be:

```
1   count = 0
2   while(Table 1 has more rows) {
3       Read the top row X from the Table 1
4       Move X to Table 2
5       while (Table 1 has more rows) {
6           Read the top row Y from Table 1
7           if (X.Physics == Y.Physics) {
8               count = count + 1
9           }
10          Move Y to the Table 3
11      }
12      Move all rows from Table 3 to Table 1
13  }
```

Option c): A single loop can find the number of the words which have highest letter count from the "Scores" dataset. The pseudocode can be:

```
1   max = 0, count = 0
2   while(Table 1 has more rows) {
3       Read the top row X from Table 1
4       if (X.LetterCount == max) {
5           count = count + 1
6       }
7       if (X.LetterCount > max) {
8           max = X.LetterCount
9           count = 0
10      }
11      Move X to Table 2
12  }
```

Option d): In this case, a single loop can find the numbers of bills from the same shop from the "Shopping Bills" dataset. Assume we want to find the number of bills from Big Bazaar. The pseudocode can be:

```
1   count = 0
2   while(Table 1 has more rows) {
3       Read the top row X from Table 1
4       if (X.ShopName == "Big Bazaar") {
5           count = count + 1
6       }
7       Move X to the Table 2
8   }
```

Therefore, a) and b) are the correct options

Question-2 [4 Marks]

Statement

The following pseudocode is executed using the "Words" dataset. At the end of the execution, **A** captures the number of sentences with at least two nouns that have at most two vowels. Choose the correct code fragments to complete the pseudocode.

```
1   A = 0, C = 0
2   while(Table 1 has more rows){
3       Read the first row X from Table 1
4       if(X.PartOfSpeech == "Noun" and countVowels(X) <= 2){
5           C = C + 1
6       }
7       if(X.Word ends with a full stop){
8           if(C >= 2){
9               A = A + 1
10              *** Statement1 ***
11          }
12          *** Statement2 ***
13      }
14      Move X to Table 2
15  }
16
17  Procedure countVowels (Y)
18      i = 1
19      B = 0
20      while(i <= Y.LetterCount){
21          if(ith letter of Y.Word is a vowel){
22              B = B + 1
23              *** Statement3 ***
24          }
25          *** Statement4 ***
26      }
27      return (B)
28  End countVowels
```

Options

(a)

Statement1: Not necessary
Statement2: **C** = 0
Statement3: Not necessary
Statement4: **i** = **i** + 1

(b)

Statement1: Not necessary
Statement2: **C** = 0
Statement3: **i** = **i** + 1
Statement4: Not necessary

(c)

Statement1: Not necessary

Statement2: **C** = **C** + 1

Statement3: Not necessary

Statement4: **i** = **i** + 1

(d)

Statement1: **C** = 0

Statement2: Not necessary

Statement3: Not necessary

Statement4: **i** = **i** + 1

Answer

(a)

Solution

In the first section of code, a card is being picked up and **C** is being incremented if the card has two properties. First, it is a noun and the second, **countVowels(X)** ≤ 2, Which means **countVowels(X)** is supposed to return number of vowels in the selected card (row). In the procedure **countVowels(Y)**, **i** is initialized to 1 (the first letter of word) and **B** is initialized to 0 (number of vowels seen so far). In while block, to iterate through the words' letters, **i** should be incremented in the last. Therefore,

Statement4: i = i + 1.

In the condition box, **B** is being incremented whenever a vowel is seen. Therefore, no requirement of Statement3 i.e.,

Stetement3 : Not Necessary

As we are concerned about a sentence, the second condition block of first section of code is checking if the word ends with a full stop. **A** is being incremented if there are at least two required words, which means there is no requirement of Statement1 i.e.,

Statement1 : Not Necessary.

As **C** is sentence specific variable it must be reinitialized to zero, once the sentence ends. Therefore,

Statement2 : C = 0

Therefore, Option a is the correct option.

Question-3 [3 Marks]

Statement

The following pseudocode is executed using the "Library" dataset. At the end of the execution, **N** captures the name of a book which has the maximum number of pages and is written in a language other than English, and **A** captures the number of pages in the book.

```
1   A = 0, N = "None"
2   while(Table 1 has more rows){
3       Read the first row X in Table 1
4       if(X.Language != "English" and X.Pages > A){
5           A = X.Pages
6           N = X.Name
7       }
8       Move X to Table 2
9   }
```

If the rows of the table are shuffled in any random order, then choose the correct option(s). It is a Multiple Select Question (MSQ).

Options

(a)

There will be no change in **N**, irrespective of the order of rows.

(b)

There might be a change in **N**, based on the order of rows.

(c)

There will be no change in **A**, irrespective of the order of rows.

(d)

There might be a change in **A**, based on the order of rows.

Answer

(b), (c)

Solution

Let there are two books, book1 and book2 having the maximum number of pages (say n, i.e., both have same number of pages, n) in the library dataset. If book1 is kept before book2 then **A** will store n and **N** will store book1. As we are not checking the equality condition i.e., `X.Pages >= A` (we are checking only `X.Pages > A`) when we visit book2, nothing will be changed. If the order is reversed, then **A** will store n but N will store book2. Therefore, **N** depends on the order of the books while **A** does not.

Hence, Options b and c are the correct options.

Question-4 [3 Marks]

Statement

The given pseudocode is executed using the "Shopping Bills" dataset. **frac** stores the ratio of the number of customers who purchased both "Bread" and "Milk" to the number of customers who purchased "Milk". Choose the correct code fragment to complete the pseudocode. (Assume there is at least one customer who has purchased "Milk").

```
1   mCount = 0, bCount = 0
2   while(Pile 1 has more cards){
3       Read the top card X in Pile 1
4       ********************
5       * Fill the code *
6       ********************
7       Move X to Pile 2.
8   }
9   frac = bCount / mCount
10
11  Procedure isItem (Y, A)
12      C = False
13      while(Card Y has more items){
14          Read an item Z from ItemList of card Y
15          if(Z.Item == A){
16              C = True
17          }
18          Remove Z from ItemList of Y
19      }
20      return(C)
21  End isItem
```

Options

(a)

```
1   if(isItem(X, "Milk")){
2       mCount = mCount + 1
3   }
4   if(isItem(X, "Bread")){
5       bCount = bCount + 1
6   }
```

(b)

```
1   if(isItem(X, "Bread")){
2       bCount = bCount + 1
3       if(isItem(X, "Milk")){
4           mCount = mCount + 1
5       }
6   }
```

(c)

```
1   if(isItem(X, "Milk") and isItem(X, "Bread")){
2       mCount = mCount + 1
3       bCount = bCount + 1
4   }
```

(d)

```
1   if(isItem(X, "Milk")){
2       mCount = mCount + 1
3       if(isItem(X, "Bread")){
4           bCount = bCount + 1
5       }
6   }
```

Answer

(d)

Solution

Procedure `isItem (Y, A)` returns True if item **A** is there in the item list of card Y otherwise returns False. As we are trying to find the ratio of customers who purchased both Bread and Milk to the number of customers who purchased Milk, **bCount** should stores the number of customers who buy Bread and Milk together and **mCount** should store the number of customers who buy Milk.

Option a.

bCount stores the number of customers who buy Bread (irrespective of the customers who buy Milk or not). This is not the situation we want.

Option b.

mCount stores the number of customers who buy Milk only if they buy Bread. This is not the situation we want.

Option c.

bCount and **mCount** are always same and stores the number of customers who buy both Bread and Milk. This is not the case here.

Option d.

mCount stores the number of customers who have bought the milk and **bCount** stores the number of customers who buy Bread only if they buy Milk. This the required condition.

Therefore, option d is correct.

Question (5 to 6)[5Marks]

Statement

The following pseudocode is executed using the "Scores" dataset. Two students form a study pair if their difference in Mathematics marks are at most 10. Assume that Pile P1 is always restored back after calling **studyPair(Pile P1)**.

```
1   count1 = studyPair(Pile 1)
2   while(Pile 1 has more cards){
3       Read the top card X in Pile 1
4       if(X.CityTown == "Chennai"){
5           Move X to Pile CHN
6       }
7       if(X.CityTown == "Bengaluru"){
8           Move X to Pile BLR
9       }
10      if(X.CityTown == "Vellore"){
11          Move X to Pile VLR
12      }
13  }
14  count2 = studyPair(Pile CHN) + studyPair(Pile BLR) + studyPair(Pile VLR)
15  count3 = count1 - count2
16
17  Procedure studyPair(Pile P1)
18      A = 0
19      while(Pile P1 has more cards){
20          Read the first card in Pile P1
21          Move X to Pile P2
22          while(Pile P1 has more cards){
23              Read the top card in Pile P1
24              Move Y to Pile P3
25              if(-10 <= X.Mathematics - Y.Mathematics <= 10){
26                  A = A + 1
27              }
28          }
29          Move all cards from Pile P3 to Pile P1
30      }
31      return(A)
32  End studyPair
```

Question 5 [3 Marks]

Statement

What will **count1** represent at the end of execution?

Options

(a)

Number of study pairs

(b)

Number of pairs of study pair

(c)

Number of students who formed study pairs

(d)

Number of study pairs from the same city

Answer

(a)

Question-6 [3 Marks]

Statement

What will **count3** represent at the end of execution?

Options

(a)

Number of study pairs where at least one student in each pair is not from the cities Chennai, Bengaluru, and Vellore

(b)

Number of study pairs where both the students in each pair are not from the same city among Chennai, Bengaluru and Vellore

(c)

Number of study pairs where students in each pair are from different cities among Chennai, Bengaluru and Vellore

(d)

Number of study pairs where students in each pair are from the same city among Chennai, Bengaluru and Vellore

Answer

(b)

Solution

`studyPair(Pile P1)` returns the number of study pairs (X, Y) formed from Pile P1, where marks difference between X and Y is maximum 10. **count1** is the total number of study pairs formed. Therefore, Option a is the correct answer for question 5.

Pile CHN is the pile created from the students of Chennai. Therefore, `studyPair(Pile CHN)` returns the number of study pairs (X, Y) formed where X and Y both are from Chennai. Similarly **count2** is the number of study pairs (X, Y) formed, where either X and Y both are from Chennai or X and Y both are from Bangalore or X and Y both are from Vellore.

In simple words **count2** is the number of study pairs where both the students in a pair are from same city among cities Chennai, Bengaluru, and Vellore.

count3 = count1 - count2

Therefore, **count3** is just the negation of **count2** i.e., number of study pairs where both the students in a pair are not from same city among cities Chennai, Bengaluru, and Vellore. The possible examples are (Kerala, Vellore), (Erode,
Salem), (Chennai, Bengaluru) etc.

There is option c which looks like option b but it says Number of study pairs where students in each pair are from different cities among Chennai, Bengaluru, and Vellore. Which means both the students must belong to at least one of the cities among Chennai, Bengaluru, and Vellore but not from same city. Therefore, (Kerala, Vellore) will not be a pair according to option c.

Therefore, Option b is the correct option for the question 6.

Question-7 [3 Marks]

Statement

The following pseudocode is executed using the "Words" dataset.

```
1   count = 0
2   while(Table 1 has more rows){
3       Read the first row X in Table 1
4       Move X to Table 2
5       i = 1, A = False, B = False
6       while(i <= X.LetterCount){
7           if(ith letter of X.Word is a vowel){
8               if(A){
9                   B = True
10              }
11              A = True
12          }
13          else {
14              A = False
15          }
16          i = i + 1
17      }
18      if(B){
19          count = count + 1
20      }
21  }
```

What will **count** represent at the end of execution?

Options

(a)

Number of words with at least one pair of vowels occurring consecutively

(b)

Number of words with at most two pairs of vowels occurring consecutively

(c)

Number of words with at least two pairs of the same vowel occurring consecutively

(d)

Number of words with at most two pairs of the same vowel occurring consecutively

Answer

(a)

Solution

The above pseudocode is executed on the "Words" dataset and we are required to find what count represents at the end of execution. From the pseudocode we can conclude that count will only be incremented when B is True. To understand the above pseudocode let us choose a word "value", and go through the pseudocode with this word.

letter	i	A		count	Comments
v	1	False	False	0	Neither A nor B updated for consonant
a	2	True	False	0	A updated because of vowel. No change in B for the first vowel
l	3	False	False	0	A changed False because of consonant
u	4	True	False	0	A updated because of vowel. No change in B for the second vowel too.
e	5	True	True	1	A is True because of vowel. But B also changed because of consecutive vowel

From the above created table for the word "value", **B** holds True. Further, **B** will not be updated once it becomes True for a word. That means count will be incremented for the word with at least one pair of vowels occurring consecutively.

Question-8 [4 Marks]

Statement

The following pseudocode is executed using the "Scores" dataset. At the end of the execution, **A, B** and **C** capture the number of pairs of students who scored at most 200, from 201 to 250 and at least 251, respectively who are from the same city but are of different gender. Choose the correct code fragment(s) to complete the pseudocode. It is a Multiple Select Questions(MSQ)

```
1   A = 0, B = 0, C = 0
2   while(Table 1 has more rows){
3       Read the first row X in Table 1
4       if(X.Total <= 200){
5           Move X to Table 2
6       }
7       if(X.Total >= 201 and X.Year <= 250){
8           Move X to Table 3
9       }
10      if(X.Total >= 251){
11          Move X to Table 4
12      }
13  }
14  A = similarTotal(Table 2)
15  B = similarTotal(Table 3)
16  C = similarTotal(Table 4)
17
18  Procedure similarTotal(Table T1)
19      D = 0
20      while(Table T1 has more rows){
21          Read the first row Y in Table T1
22          Move Y to Table T2
23          while(Table T1 has more rows){
24              Read the first row Z in Table T1
25              Move Z to Table T3
26              *****************************
27              * Fill the code *
28              *****************************
29          }
30          Move all rows from Table T3 to Table T1
31      }
32      return(D)
33  End similarTotal
```

Options

(a)

```
1   if(Y.CityTown == Z.CityTown){
2       if(Y.Gender != Z.Gender ){
3           D = D + 1
4       }
5   }
```

(b)

```
1  if(Y.Gender != Z.Gender ){
2      if(Y.CityTown == Z.CityTown){
3          D = D + 1
4      }
5  }
```

(c)

```
1  if(Y.CityTown == Z.CityTown or Y.Gender != Z.Gender ){
2      D = D + 1
3  }
```

(d)

```
1  if(Y.CityTown == Z.CityTown and Y.Gender != Z.Gender ){
2      D = D + 1
3  }
```

Answer

(a), (b), (d)

Solution

The above pseudocode is executed on the "Scores" dataset. At the end of the execution, variables A , B and C capture the number of pairs of students who scored scored at most 200, from 201 to 250 and at least 251, respectively and are from the same city but of different gender. But the pseudocode has to be completed with the correct code fragment from the given options. Let us observe the given pseudocode.

In the main part of the pseudocode, three bins are created based on the total marks. The first bin i.e. Table 2 stores the students who scored at most 200 marks in total, the second bin i.e. Table 3 stores the students who scored from 201 to 250 marks in total and the third bin i.e. Table 4 stores the students who scored at least 251 marks in total. Then procedure similarTotal is called separately with created bins as an input (argument). The procedure similarTotal contains a nested while loop. This nested while loop should create pairs of students from the created bins as mentioned in the problem. The condition for checking the same city and different gender should be in the inner while loop of the procedure similarTotal. The missing code fragment can be written as:

```
1  if (Y.CityTown == Z.CityTown and Y.Gender != Z.Gender ) {
2      D = D + 1
3  }
```

Here two conditions are connected with word "and", which could be converted in two conditions using nested loop which is given in option a and b. Therefore, options a, b, and d are correct.

Question-9 [2 Marks]

Statement

The given pseudocode is executed using "Scores" dataset. Let **B** be a positive integer value. What does the procedure **DoSomething** compute?

```
1   Procedure DoSomething (B)
2       C = 0, D = 100
3       while(Table 1 has more rows){
4           Read the first row X in Table 1
5           if(X.Chemistry > C){
6               C = X.Chemistry
7           }
8           if(X.Chemistry < D){
9               D = X.Chemistry
10          }
11          Move X to Table 2
12      }
13      if(C - D >= B){
14          return (False)
15      }
16      else {
17          return (True)
18      }
19  End DoSomething
```

Options

(a)

Returns True if and only if the difference between the maximum Chemistry marks and the minimum Chemistry marks is at least **B**

(b)

Returns True if and only if the difference between the maximum Chemistry marks and the minimum Chemistry marks is at most **B**

(c)

Returns True if and only if the difference between the maximum Chemistry marks and the second maximum Chemistry marks is at most **B**

(d)

Returns True if and only if the difference between the maximum Chemistry marks and the minimum Chemistry marks is less than **B**

Answer

(d)

Solution

Here the procedure DoSomething accepts the parameter B which is a positive integer. C is initialized with 0 and being updated with the Chemistry mark of a student whenever the Chemistry mark of the student is more than the current value of C. Therefore, C stores the maximum mark in Chemistry obtained by any student. D is just the opposite of C which stores the minimum marks in Chemistry obtained by any student. procedure DoSomething returns False when C - D is greater than or equal to B i.e., at least B. Therefore, it returns True whenever the difference between maximum Chemistry marks and the minimum Chemistry marks is less than B. Therefore, Option d is correct.

Question-10 [4 Marks]

Statement

The following pseudocode is executed using the "Words" dataset. At the end of the execution, **A** captures the number of nouns with letter count at least four and at most eight. But the pseudocode may have mistakes. Identify all such mistakes (if any). Assume that all statements not listed in the options below are free of errors. It is a Multiple Select Question (MSQ).

```
1   C = 0
2   while(Table 1 has more cards){
3       Read the first row X from Table 1
4       if(CheckSomething(X, 4, 8)){
5           C = C + 1
6       }
7       Move X to Table 2
8   }
9   Procedure CheckSomething(Y, C1, C2,)
10      if(Y.PartOfSpeech == "Noun"){
11          if(C1 <= Y.LetterCount and Y.LetterCount <= C2){
12              return (True)
13          }
14          else {
15              return (False)
16          }
17      }
18      else {
19          return (True)
20      }
21  End CheckSomething
```

Options

(a)

Line 4: Incorrect parameters used to call the procedure

(b)

Line 5: **C** is wrongly updated

(c)

Line 11: Incorrect conditional statement

(d)

Line 19: Incorrect value for return

(e)

No error

Answer

(d)

Solution

Here C captures the number of nouns with letter count at least four and at most eight. In the pseudocode, C is being incremented when `CheckSomething(X, 4, 8)` returns True. Therefore, `CheckSomething(Y, C1, C2)` should return True whenever, Y.Word is a noun and the letter count of Y.Word is between 4 and 8 including the boundaries. At Line 4, the correct parameters are used to call the procedure and C is being incremented at line 5. Therefore, Line 4 and Line 5 are correct.

In the procedure, Line 10 and Line 11 are the nested filters and contains the correct filters. If these conditions are satisfied the procedure should return True which is being done here. But if any of these two conditions fails, the procedure should return False, which is correct in Line 15 but it is incorrect in Line 19 (It should return False `if X.PartOfSpeech != "Noun"`). Therefore, there is an error in Line 19. Which means, the correct option is d only.

Question-11 [4 Marks]

Statement

The following pseudocode is executed using the "Library" dataset. At the end of the execution, **A** captures the number of pairs of books which are published in the same genre and in the same year but in different languages. But the pseudocode may have mistakes. Identify all such mistakes (if any). Assume that all statements not listed in the options below are free of errors. It is a Multiple Select Question (MSQ).

```
1   A = 0
2   while(Table 1 has more cards){
3       Move X to Table 2
4       Read the first row X from Table 1
5       while(Table 1 has more rows){
6           Read the first row Y from Table 1
7           B = False, C = False, D = True
8           if(X.Genre == Y.Genre){
9               B = True
10          }
11          if(X.Year == Y.Year){
12              C = True
13          }
14          if(X.Language == Y.Language){
15              D = False
16          }
17          if(B and C and D){
18              A = A + 1
19          }
20          Move Y to Table 3
21      }
22      Move all rows from Table 3 to Table 1
23  }
```

Options

(a)

Line 1: **A** is initialized with wrong value

(b)

Line 9: **B** is updated with wrong value

(c)

Line 12: **C** is updated with wrong value

(d)

Line 15: **D** is updated in wrong place

(e)

No errors

Answer

(e)

Solution

As A captures the number of pairs of books which are published in the same genre and in the same year but in different languages. Therefore, it should be initialized with 0. Line 1 is right.

Line 18: Will be executed when B, C, and D all are True.
Line 9: B is being True only when the genres are same and that is what is required. Therefore, Line 9 is correct.
Line 12: C is being True only when the years are same and that is what is required. Therefore, Line 12 is correct.
Line 15: D is being False when ever languages are same which means it is True only when the languages are different and that is what is required. Therefore, Line 15 is correct.

Therefore, this code does not have any error.