Exercise 4

1. Discuss why the isolation property of ACID properties will apply to both an Online shopping platform as well as an Online banking system despite that they are different applications dealing with different data.
2. In a nested transaction, a transaction PARENT has three sub-transactions A, B, and C. For each of the following scenarios, answer which of these four transactions' commits can be made durable, and which ones have to be forced to rollback.
   - Scenario 1: Commit by A, B, and C; but PARENT rolls back.
   - Scenario 2: Commit by A, B, C, and PARENT.
   - Scenario 3: Commit by A, B, and PARENT; but C rolls back.
3. Discuss why using a single process for all the transaction processing monitor services is not a good idea.
4. We have seen flat transactions in class. The following flat transaction definition creates a problem for the system and shows why flat transactions alone cannot be used. Please discuss the example and explain the associated issue:

```
GiveEndofYearBonus()
   {  real bonus;
    receive(bonus);
    exec sql BEGIN WORK;
        exec SQL UPDATE customer
        set account = account + :bonus
    exec sql COMMIT WORK;
   }
```

5. What is the difference between a singleton select and a cursor.
6. What is the value of `AccBalance1` after running the following transaction operations? Discuss why save points are needed.

```
BEGIN WORK
SAVE WORK 1
AccBalance1 = 100;
AccBalance2 = 50;
SAVE WORK 2
AccBalance3 = AccBalance1 + AccBalance2;
AccBalance1 = 0;
AccBalance2 = 0;
SAVE WORK 3
ROLLBACK WORK (2)
AccBalance3 = AccBalance1;
AccBalance1 = 0;
SAVE WORK 4
AccBalance3=AccBalance3 + AccBalance2;
ROLLBACK WORK (2)
AccBalance2 = AccBalance2 + 100;
COMMIT WORK
```

7. In the following quadtree the division of space is based on a rule that each quadrant could only have at most one data point. Based on that we can see that the quadtree is not properly formed. Please finish the space subdivision process for this tree.