Solutions to Sample Coding Questions

Solution to Sample Question 1

Part 1. (10 points) Predict the output of the following code, which is similar to the RM2 policy in Lab 2.

```
[3]: import numpy as np
     data=np.array([100,70,50,30,200])
     order=np.array([4,0,1,2,3])
     price=60
     left=3
     tot=0
     for element in data[order.argsort()]:
         if element>=price:
             tot+=price
             left-=1
         if left==2:
             price=100
         elif left==1:
             price=150
         elif left==0:
             break
     print(tot)
```

```
160
```

To understand what's going on, you can print each step of the above code to have the computer help you take baby steps to work out everything line by line. Also you can watch last part of the video on the review session on 2/22 for a walk-through.

Note that the first `if` statement, `if element>=price`, along with the next two indented lines, is one block. The next group of `if left==2` followed by two `elif` statements are one block. The two blocks are executed one after another, with no relationship in between. On the other hand, the first `elif` statement is only checked if the first `if left==2` statement does not hold. The second `elif` is checked only if the `if` and the first `elif` does not hold. `elif` stands for "else if".

Part 2. (15 points)

Completed Solution:

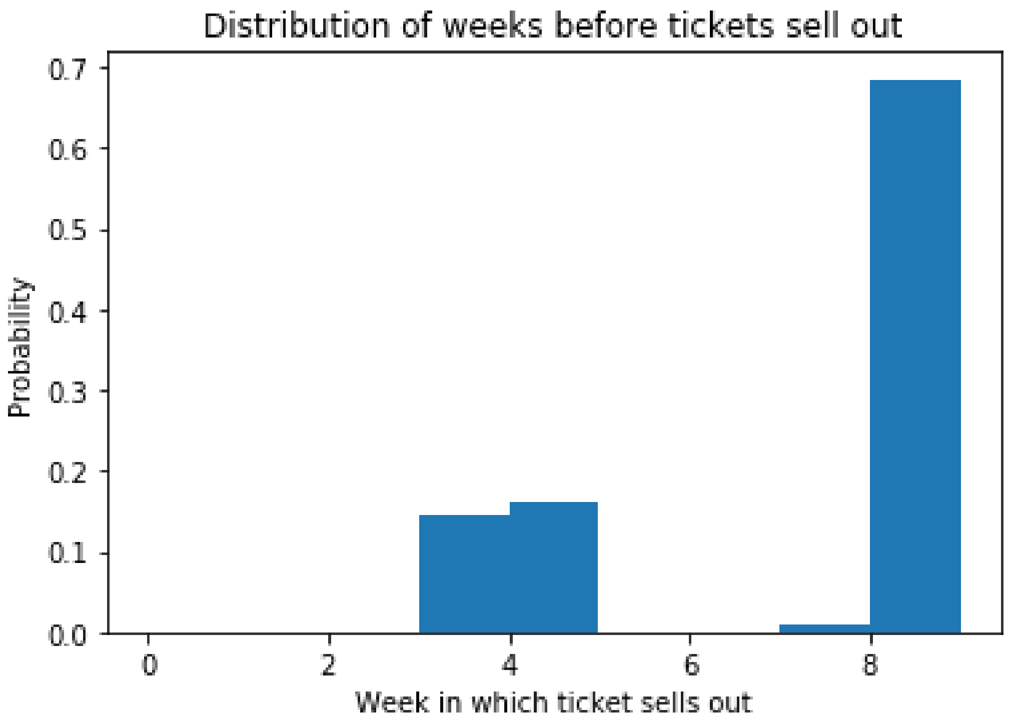
```
[ ]: from scipy.stats import bernoulli,poisson
     import numpy as np

     def generateScenario():
         x=bernoulli(p=0.3).rvs()
         if x==1:
             return poisson(mu=100).rvs(size=8)
         else:
             return poisson(mu=45).rvs(size=8)

     def simulateScenario(data,inventory):
         i=0
         for demand in data:
            inventory-=demand
            if inventory<=0:
                break
            i+=1
        return i

    inventory=400
    dataset=[generateScenario() for i in range(1000)]
    values=[simulateScenario(data,inventory) for data in dataset]
    import matplotlib.pyplot as plt
    plt.hist(values,bins=range(10),density=True)
    plt.title('Distribution of weeks before tickets sell out')
    plt.ylabel('Probability')
    plt.xlabel('Week in which ticket sells out')
    plt.show()
```

```
[59]: # Expected output when complete.
```



Solution to Sample Question 2

Part 1. (10 points) Predict the output of the following code

```
[4]: import numpy as np

    def f(x):
        x[1:]=x[:-1]
        x[0]=0
        s=np.sum(x)
        x[0]=max(0,15-s)
        return x

    print(f(np.array([3,8,2]))[0])
```

```
4
```

Part 2. (15 points)

```
[5]: import numpy as np

    def simulate(data,beds,stay):
        pipeline=np.zeros(stay,dtype=int)
        totRejected=0
        day=1
        for demand in data:

            # BEGIN
            pipeline[1:]=pipeline[:-1]
            pipeline[0]=0
            occupied=sum(pipeline)
            openBeds=max(0,beds-occupied)
            admitted=min(openBeds,demand)
            pipeline[0]=admitted
            # End

            rejected=demand-admitted
            print('On day {0}, {1} incoming patient(s) is rejected.'.format(day,rejected))
            totRejected+=rejected
            day+=1
        return totRejected

    data=[6,10,3,8,4,6]
    stay=3
    beds=15
    ans=simulate(data,beds,stay)
    print('Total number of rejected patients is', ans)
```

```
On day 1, 0 incoming patient(s) is rejected.
On day 2, 1 incoming patient(s) is rejected.
On day 3, 3 incoming patient(s) is rejected.
On day 4, 2 incoming patient(s) is rejected.
On day 5, 0 incoming patient(s) is rejected.
On day 6, 1 incoming patient(s) is rejected.
Total number of rejected patients is 7
```

Solution to Sample Question 3

Part 1: (10 points) Predict the output of the following code.

```
[6]: def f(x):
         return 3*x

     x=np.array([3,6,2,10])
     y=np.array([5,4,2,9])
     a=np.sum(x-y)
     b=np.sum(x>y)
     c=np.sum(x<y)
     d=len(x)
     e=np.sum(np.maximum(x-y,0))
     l=[f(x) for x in [a,b,c,d,e]]
     print(l)
```

```
[3, 6, 3, 12, 9]
```

Part 2: (15 points)

```
[1]: import numpy as np

     def simulateScenario(profitA,profitB):

         # BEGIN
         numDays=len(profitA)
         numBigger=np.sum(profitA>profitB)      # a) Compute number of days A is bigger
         avgDiff=np.average(profitA-profitB) # b) compute difference in mean
         diff=profitA-profitB                  # c) compute average gain conditional on A is b
         if numBigger==0:
             avgGain=np.nan
         else:
             avgGain=np.sum(np.maximum(diff,0))/numBigger
         stdDiff=np.std(diff)
         prob=numBigger/numDays
         # END

         return prob,avgDiff,stdDiff,avgGain

     profitA=np.array([10,5,8,4,6])
     profitB=np.array([11,8,3,7,6])
     prob,avgDiff,stdDiff,avgGainCondBigger=simulateScenario(profitA,profitB)

     print('The profit for A is strictly larger than B with probability {0:.0%}'.format(prob)
     print('The expected profit for A minus the expected profit for B is',avgDiff)
     print('The standard deviation in the difference in expected profit is {0:.2f}'.format(st
     print('On days when profit for A is larger, it is larger on average by',avgGainCondBigge
```

```
The profit for A is strictly larger than B with probability 20%
The expected profit for A minus the expected profit for B is -0.4
The standard deviation in the difference in expected profit is 2.94
On days when profit for A is larger, it is larger on average by 5.0
```