

Operations Analytics MOOC: Practice Problems for Week 1

You can use any of the excel files posted online to work through the Practice Problems.

SOLUTIONS

Q1. Consider the newsvendor problem that we saw in session 1 of the course. Assume you are the retailer who orders goods at 3 talers an item from the manufacturer and sells it in stores at 12 talers an item to customers. You decide your order quantity Q and place the ordered units on shelves before the uncertain demand is realized. Consider the following scenario: You decide to buy $Q=100$ items and the customer demand turns out to be 87 items.

Calculate the **profits** accrued in this scenario.

- (a) 30
- (b) 100
- (c) 300
- (d) 744
- (e) 783
- (f) 900
- (g) 1200

Correct answer: d). $\text{Profit} = \text{price} * \text{demand} - \text{cost} * Q = 12 * 87 - 3 * 100 = 1044 - 300 = 744.$

Q2. *MedPlus Company* owns pharmacies/drug stores in several US cities. Demand for Flu shots at a store in center-city Philadelphia, can be modeled by a random variable that takes the following values in five different scenarios that occur with the following probabilities.

Scenario 1:	$D_1 = 10$ with probability $p_1 = 0.2$
Scenario 2:	$D_2 = 20$ with probability $p_2 = 0.2$
Scenario 3:	$D_3 = 40$ with probability $p_3 = 0.2$
Scenario 4:	$D_4 = 60$ with probability $p_4 = 0.2$
Scenario 5:	$D_5 = 80$ with probability $p_5 = 0.2$

What is the **mean** of this demand distribution?

- (a) 10
- (b) 31
- (c) 42
- (d) 50
- (e) 60
- (f) 80

Correct answer: (c) $\text{mean} = 0.2 * 10 + 0.2 * 20 + 0.2 * 40 + 0.2 * 60 + 0.2 * 80 = 2 + 4 + 8 + 12 + 16 = 42.$

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Q3. Consider the demand distribution for the store given in the previous question. Find the **standard deviation** of this demand distribution.

- (a) 15.11
- (b) 25.61
- (c) 33.99
- (d) 44.99
- (e) 50.99

Correct answer: (b) Using slide equations, we get a standard deviation of 25.61. You can see the steps for calculating standard deviation for a demand distribution in slides 28 to 30 in Week 1 Session 1.

Q4. A data set has 20 points drawn from a particular demand distribution (not the one mentioned in questions Q2 and Q3). Find the descriptive sample statistics: namely, **the sample mean and standard deviation**.

78	66	95	87
57	97	114	44
74	85	95	88
69	86	50	70
90	43	61	80

- (a) Mean= 65 and standard deviation= 14.33
- (b) Mean= 88 and standard deviation=25.95.
- (c) Mean= 76.45 and standard deviation= 67.45
- (d) Mean= 76.45 and standard deviation= 18.96
- (e) Mean= 76.45 and standard deviation= 76.45
- (f) Mean=18.95 and standard deviation= 76.45

Correct answer: (d) mean=76.45 and standard deviation=18.96. You can calculate these statistics using the approach shown in Slide 4, in Week 1 Session 2 Slides.

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Q5. Here is a table of the number of downloads observed in each of the past 20 periods of observation for a new pop song posted on *MusicTunes* in the App store.

Period	Demand
1	1
2	39
3	19
4	5
5	97
6	44
7	49
8	95
9	46
10	56
11	3
12	90
13	2
14	19
15	66
16	48
17	11
18	92
19	99
20	86

Using the Moving Averages of “5” method, i.e., MA (5), calculate the moving averages for periods 6 through 20. Now calculate the errors in your forecasts. What is the **Mean squared error** from the data? Choose the closest numerical answer.

- (a) 300
- (b) 600
- (c) 1000
- (d) 1400
- (e) 2000
- (f) 3000

Correct answer: d). MSE=1389.57 using excel calculations. Closest number is 1400. For steps on how to calculate MSE, see Week1ErrorsTemplate and Week1ErrorsSolution excel files. Also see Slide 25 in Week 1 Session 2.

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Q6. Examine the data from the above question. Using the Moving Averages of “3” method, i.e., MA (3), calculate the moving averages for periods 4 through 20. Now calculate the errors in your forecasts. What is the **Mean Absolute Percentage Error** calculated from the data? Choose the closest numerical answer.

- (a) 3%
- (b) 10%
- (c) 20%
- (d) 40%
- (e) 100%
- (f) 200%
- (g) 300%

Correct answer: (g). For steps on how to calculate MAPE, see Week1ErrorsTemplate and Week1ErrorsSolution excel files. Also see the example in Slides 25 of Week1 Session 2. Using excel calculations, MAPE=327.97% using excel calculations. Closest number is 300%.

Q7. In a data set with 2500 points, the sample mean was calculated to be 3980, and the sample standard deviation was calculated to be 1000. Assuming that the data were generated from a random output that was distributed according to a Normal distribution, what is the **mean and standard deviation** that you would use for predicting the next sample.

- (a) $\mu=3980$ and $\sigma=1000$.
- (b) $\mu=3980$ and $\sigma=1020$.
- (c) $\mu=3980$ and $\sigma=1200$.
- (d) $\mu=4000$ and $\sigma=1000$
- (e) $\mu=4000$ and $\sigma=1020$
- (f) $\mu=4000$ and $\sigma=1200$.

Correct answer: (b) Prediction mean μ =descriptive mean=3980, and standard deviation for prediction $\sigma=1000+ 1000/\sqrt{2500} = 1020$. See Slide 14 of slides posted for Week 1 Session 2.

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Q8. The *Surf-n-Turf* store in Southern California sells surf boards. The seasonality factors for the demand for one particular model of surf board over 12 months of the year are as follows:

Month	Seasonal Factor
January	0.6
February	0.7
March	0.9
April	1.1
May	1.5
June	1.6
July	1.8
August	0.9
September	0.7
October	0.8
November	0.7
December	0.7

The de-seasonalized forecast for demand in the month of July is 1433 surf boards. What is the **correct seasonalized forecast** for the actual demand in July?

- (a) 1289.7
- (b) 1576.3
- (c) 2149.5
- (d) 2292.8
- (e) 2579.4
- (f) 2978.1
- (g) 3345.3

Correct answer: (e) The seasonalized forecast = De-seasonalized forecast * seasonal factor (for July) = $1433 \times 1.8 = 2579.4$. You can review the steps by examining slide 25 of Week1 Session 3.

Q9. What is the main drawback of using the Moving Averages forecasting method for forecasting data that shows an increasing trend?

- (a) Moving average forecast estimates overestimate the trend.
- (b) Moving average forecasts are decreasing.
- (c) Moving average forecasts exhibit seasonality.
- (d) Moving average forecasts lag behind the trend in the data.
- (e) Moving average forecasts are unstable.

Correct answer: (d)
Moving averages lag behind the trend in the data. See Slide 7 in Week 1 Session 3.

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Q10. A retail company called *Hoth Ice Inc.* uses a forecasting method that compares the actual observed demand for several products to their forecasts, mainly to understand errors in their forecasting process. Specifically, *Hoth Ice Inc.* uses the ratio of actual demand to forecasts, called an AF ratio. The average AF ratio is 1.00 and standard deviation of the AF ratios is 0.30.

The demand planners at *Hoth Ice Inc.* generate a subjective forecast for one of their new products, and the forecast is 2000 units. What are the **descriptive statistics for the normal distribution** that would describe the uncertainty in their forecast?

- (a) Mean=1000 and standard deviation=300.
- (b) Mean=1000 and standard deviation=600.
- (c) Mean=300 and standard deviation=300.
- (d) Mean=2000 and standard deviation=300.
- (e) Mean=2000 and standard deviation=600.
- (f) Mean=2000 and standard deviation=900.
- (g) Mean=2000 and standard deviation=1000.

Solution: (e) Mean A/F=1.00 Std. deviation of A/F =0.3 Therefore mean =1.00*2000=2000 and Standard deviation =0.3*2000=600. See slide 12 Week 1 Session 4 for details.