1.

The H&S Motor Company produces small motors at a production cost of $30 per unit. Defective motors can be reworked at a cost of $12 each. The company produces 100 motors per day and averages 80 percent good quality motors. Based on past experience, 50% of the defective motors can be reworked prior to shipping to customers. These are also considered good motors. A good motor can be sold for $100 while a defective motor can be scrapped and sold for $15. Income consists of both the revenue from the sold motors and the scrapped motors.

a) Using the number of good motors shipped as the measure of output and the cost of production as the input, what is the company's productivity if no defective motors are reworked?

b) Suppose that the company now uses the total income as the output measure and the cost of production as the input. What is the company's productivity if no defective motors are reworked?

c) Now suppose the company reworks the defective motors that can be reworked. Using the number of good motors shipped as the measure of output and the cost of production as the input, what is the company's productivity now?

d) What is the percent change in productivity comparing the productivity in c) to the productivity in a)

2.

A toy company buys large quantities of plastic pellets for use in the manufacture of its products. The production manager wants to develop a forecasting system for plastic pellet prices. The price per pound of plastic pellets has varied as shown:

Month	**Plastic Pellets Price/Pound**	**Month**	**Plastic Pellets Price/Pound**
1	$0.39	9	$0.35
2	$0.41	10	$0.38
3	$0.45	11	$0.39
4	$0.44	12	$0.43
5	$0.40	13	$0.37
6	$0.41	14	$0.38
7	$0.38	15	$0.36
8	$0.36	16	$0.39

Provide your forecast for Month 17 using the moving average, weighted moving average, and exponential smoothing methods as follows:

a) For the moving average, use a 4-period moving average.

b) Use a three-period weighted moving average. Unfortunately, you spilled water on the sheet with the weights to be used for the weight moving average and this blurred the weight for the most recent period. However, you can tell that the weights for the second and third most recent months are 0.25 and 0.15 respectively.

c) For exponential smoothing, using an $\alpha = 0.3$, and the forecast for Month 6 was $0.40.

d) Using the methods in a) through c), which method provides the better forecast for Month 17? Why? Your selection criteria must be based on the forecasts for Months 12 through 16 using one of the one of the numerical evaluation methods we have learned and used on homework assignments this term.

Provide your forecasts to three decimal places ($0.xxx).

3.

Barney's Boston Bagel 'n Bun Bakery is looking into a new type of bag tie that will better seal, and more importantly, better reseal the company's bagels after they have been taken home. The process that it is using at this time without the new bag tie is referred to as *Current* and will use the *old bag tie*. According to a competitive analysis of Barney's bagels compared to those of the competition, the new bag ties would dramatically increase the shelf life of the bagels. Barney currently sells all the bagels the company can make, 5,000 bags of bagels a week. The new tie would cost $0.02 more than the old one, but the longer shelf life would create incremental value to the customer

a) In addition to the cost of the new ties, assume that the new tie would require a machine that would add $200 per week to the company's fixed costs. How much more should Barney's charge per bag in order to make the same profit as it made using the *Curren*t process?

b) Instead of the modification in a), Barney's is considering adding a faster machine along with a second baker. For this modification, a new tie costing $0.03 more than the *old bag tie* is required. In addition to the additional cost of this new tie, this would add $1,500 per week to the company's fixed costs but would triple the company's output. How much should the company add to the price of a bag of bagels if it wants to increase profit by at least $3,000 per week compared to the *Current* operation.

c) Barney has decided to add $0.40 for the price of a bag and wants to make $3,000 per week compared to the *Current* operation. He will be adding the faster machine, the new tie and the second baker explained in b) above. How many bags of bagels will he need to produce to make $3,000 per week compared to the *Curren*t operation using the *old bag time*?

4.

a) Operations management concepts can be applied to both manufacturing and service operations. It can often be more challenging to apply them in a service operation. *Briefly describe* at least two of the challenges that a service operation presents for the application of operations management concepts that are not found in a manufacturing operations. *Briefly describe* a way to address one of the challenges that you have identified.

b) Six Sigma and TQM approach quality from different perspectives. For a customer service operation, explain how each of these two approaches could be used to address the complaints that are being received from the customers about the poor customer service.

5.

A company is going to introduce a new cell phone. ABC Cell Services is going to sell the phones and has established specification limits of 5.0 ounces and 5.5 ounces for the weight of the phone. The company currently has determined that its phones currently weigh 5.2 ounces.

a) If the company wants to have a C_{pk} of 2.0 or greater (equivalent to a six sigma process), what is the maximum value of the standard deviation (σ) so that the C_{pk} of the process indicates that the company can provide the six sigma process (process capability = 2.0)?

b) Suppose that the company is operating at a standard deviation (σ) of 0.025. What is the range on the mean of the process to maintain a C_{pk} of 2.0 or greater?

c) Suppose that the company can maintain an average weight of 5.2 ounces and a standard deviation (σ) of 0.05 ounces. The company does not believe it can improve on these values. The company wants to see if ABC would be willing to adjust its spec limits rather them keep them at 5.0 and 5.5 if necessary to meet the minimum C_{pk} of 2.0. What should the company tell ABC that it would need to adjust the spec limits to in order to ensure a C_{pk} of 2.0 or greater?

6.

Joe Builder has located a piece of property that he plans to buy and build on and then sell to a third party. The land is currently zoned for four homes per acre, however Joe is planning to request that it be rezoned. What Joe builds depends on the approval of the rezoning request and your analysis of his situation. With his input and your help, the decision process has been reduced to the following costs, alternatives and probabilities:

Cost of land: $2 million
Probability of rezoning: 0.60
If the land is rezoned, there will be additional costs for new roads, lighting, etc. of $1 million. This will be referred to as property improvements.

If the land is rezoned, Joe must decide whether to build a shopping center or 1,500 apartments. In either case, Joe is planning to sell the property after he has built either the shopping center or apartments. He is certain that he can sell the property, although there are probabilities associated with who would be the buyer. If a shopping center is built, it can be sold to either an insurance company for a profit of $5 million before the cost of the land and the property improvements or to a large department store chain for a profit of $4 million before the cost of the land and property improvements are considered. The probability of selling it to the department store chain is 70 percent so that the probability of selling it to the insurance company is 30 percent. If, instead of the shopping center, he decides to build the 1,500 apartments, the probabilities on the profits for selling them are as follows:

40 percent chance he can get a profit of $2,000 for each apartment before the cost of the land and property improvements are considered, or
60 percent chance he can get a profit of $3,000 for each apartment before the cost of the land and property improvements are considered.

If the land is not rezoned, Joe will comply with the existing zoning restrictions and simply build 600 homes on which he expects to make a profit of $4,000 on each one before the cost of the land is considered.

Using the decision tree and expected value approach, determine the best solution for Joe and his expected net profit. In providing your answer include your decision tree.

7.

The Security National Bank is considering two locations for a new branch. The two choices are a major mall and a strip mall. The site selection team is evaluating two sites, and they have scored the critical success factors for each as shown below. The weights reflect the same relative importance as we have used in class. They want to use these ratings to compare the locations.

Critical Success Factor	Factor Weight	Major Mall Site	Strip Mall Site
Relocation cost	0.30	$190,000	$240,000
Customer service	0.40	2.5	3.0
Service quality	0.10	1.8	2.4
Security and safety	0.10	2.4	1.8
Market share	0.10	1.8	2.1

The non-economic scores are on a 0 to 3.0 basis with 3.0 being best and it is possible to achieve the 3.0 score.

a) Using the factor scoring (rating) method as we learned in class, which site should Security National Bank use based on the above information?

b) Suppose the 3.0 value for the Customer Service for the Strip Mall Site is questionable. At what Customer Service score would the bank change its decision from what it found in a)?

8.

The registrar at State University believes that decreases in the number of freshman applications that have been experienced are directly and linearly related to tuition increases. They have collected the following enrollment and tuition data for the past ten years:

Year	1	2	3	4	5	6	7	8	9	10
Freshman Applications	6010	5560	6100	5330	4980	5870	5120	4750	4615	4100
Annual Tuition ($)	3600	3600	4000	4400	4500	5700	6000	6000	7500	8000

Your work must reflect the correct independent and dependent variables based on the problem statements. This is part of the solution that is required.

a) Evaluate the registrar's belief that there is a direct relationship between the number of freshman applications as the tuition increases. What is this regression relationship and how strong is this relationship?

b) What is the expected number of applications if tuition increases to $10,000 per year?

c) Looking at the annual tuition for the past ten years, the Levy family believes that there is only a relationship between time (expressed as the Year) and the tuition. They want to plan on the total tuition for a four year college degree for their son who will be applying and if accepted enrolling beginning in year 12. What should they budget for the tuition by year for each of the four years? How strong is the relationship you are using?

9. (20 points)

ABC Insurance Company tracks absenteeism by weekly random samples. Based on historical experience and data, the company expects about 250 employs to be absent from its workforce of 5,000 on the average.

For a variety of financial reasons, the company has eliminated its flex time option for its employees. It has tracked absences over the past fifteen days. The size of each sample is 450. The numbers of absences per sample for the last 15 days are as follows:

Day	**Number Absent**	**Day**	**Number Absent**	**Day**	**Number Absent**
1	5	6	5	11	9
2	10	7	8	12	8
3	6	8	6	13	7
4	7	9	10	14	8
5	7	10	10	15	9

Assume that these 15 days are sufficient to perform this analysis.

a) Construct a 2σ control chart for the proportion absent and plot the sample data points. Base the center line and control limits using the historical absentee rate prior to the elimination of the flex time.

b) Has there been a change in the absenteeism rate? Explain why or why not and base it on the control chart results.

c) Suppose the insurance industry's standard for absenteeism is 4% (lower limit) to 8% (upper limit). What would you conclude about ABC's performance compared to the industry standard? Explain your reason and base it on the control chart results.

10. (28 points)

The Judy Gray Income Tax Service is analyzing its customer service operations during the month prior to the April filing deadline. On the basis of past data, it has been estimated that customers arrive according to a Poisson process with an average arrival rate of one every 12 minutes. The time to complete a return for a customer is exponentially distributed with a mean of 10 minutes. Assume that the customer has all of the information needed for Judy to complete the tax return at this one visit. When the person is being helped, she meets with Judy in her office. If the individual is waiting for help, she will be in the waiting area. Based on this information, answer the following questions.

Do not round your results to integer numbers.

a) If you went to Judy, how much time should you allow for getting your return done? Measure this time from when you first arrive at her office.

b) On the average, how many customers should the waiting area be designed to hold?

c) What is the probability that an arriving customer would find at least three people in the waiting area waiting for help?

d) At this time, Judy is not going to add another person to help complete the tax returns. If the arrival rate remains unchanged but the average time in the system must be 40 minutes or less, what would need to be changed and what would the value of the change need to be?

e) Judy is now considering adding a person to help her process the tax returns. This person will help Judy by checking the paper work for the customers but does not work directly with any customer. Judy believes that this will allow her (Judy) to complete the returns in six minutes 40 seconds on average. Judy would need to pay this person $50 per hour. Judy believes that she has to reduce her cost of the service by $15 per hour for every hour a customer is in her office either waiting for help or being helped. Should she add this person or continue working by herself? Base your analysis on the economics of the two options.