Question 1.

A computer systems consulting firm has read the RFPs of two contract opportunities (C1 and C2) and has decided to bid on both.

Contract C1 pertains to the selection and installation of hardware for a central computing facility together with required software. Contract C2 involves the development of a distributed computing network involving the selection and installation of hardware and any required software.

The firm may be awarded C1, or C2, both, or neither. The company used a probabilistic table as shown below to illustrate the viability of bidding on the contracts: The table shows:

* The probability of each future happening as estimated by company executives
* Profit/Loss (in $�000s) from each future based on five possible alternative contract options
* There is a bidding cost of $30,000 (total cost to bid on both contracts) � this is time, materials, and fees.

| **Company Costs and Expected Revenues** | | | | | |
| --- | --- | --- | --- | --- | --- |
|  | Future | Neither | Project C1 | Project C2 | Both C1+C2 |
| Probability | 0.1 | 0.2 | 0.3 | 0.4 |
| Alternatives | A1 | -30 | 100 | 100 | 300 |
| A2 | -30 | -200 | 150 | 450 |
| A3 | -30 | 20 | 200 | 400 |
| A4 | -30 | 100 | 100 | 200 |
| A5 | -30 | -100 | 210 | 300 |

Where:

| **Alternative** | **Project Scope** |
| --- | --- |
| A1 | Firm will subcontract hardware selection and installation, but develop software itself. |
| A2 | Firm will subcontract software development, but to select and the install hardware itself. |
| A3 | Firm will handle both the selection and installation of the hardware and develop the software itself. |
| A4 | Firm will bid jointly with a partner firm on both the hardware and software projects and share proceeds. |
| A5 | Firm will serve only as project manager, subcontracting all hardware and software tasks. |

a. Explain if any of the alternative approaches might be discarded outright  
  
b. Using the probabilities and the expected value criterion, which alternative would now be the most profitable?  
  
c. Using the Aspiration level criterion, if the profit level is set to be at least $300,000 and the loss level is set to be no more than $150,000 which alternative(s) must be eliminated?

d. Under the most probable future criterion, which alternative is preferred?

Question 2.

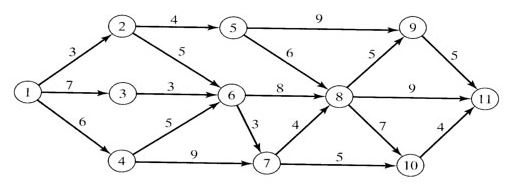
Two girder designs are under consideration for a bridge for a 1,200-foot crossing. The first design is expected to result in a superstructure weight per foot of 22(S) + 800, where S is the span between piers. The second design should result in superstructure weight per foot of 20(S) + 1,000. Piers and two required abutments are estimated to cost $220,000 each. **Let X = the number of piers plus abutments.** The superstructure will be erected at a cost of $0.55 per pound. Choose the girder design that will result in a minimum cost and specify the optimum value for **X**.  Hint: X must be an integer. An answer of X = 12.678 cannot be correct.

Question 3

. The Sun Chaser company makes two types of retractable awnings - Premium and Deluxe. Each Premium unit produced requires 50 minutes processing on Machine 1 and 30 minutes processing on Machine 2.  Each Deluxe unit produced requires 25 minutes processing on Machine 1 and 30 minutes processing on Machine 2.  At the start of the current week there are 25 Premium units and 40 Deluxe units in stock. Machine 1 has 20 hours of processing time available during the current week and Machine 2 has 15 hours of processing time available during the current week.  The demand for Premium units in the current week is forecast to be 40 units and for Deluxe units is forecast to be 50 units. How many Premium units and how many Deluxe units should be made during the current week to maximize the sum of the Premium units and Deluxe units in stock at the end of the current week?

Question 4.

. Find the critical path in the network show. Clearly show your work to receive credit.



Question 5.

A company is manufacturing integrated circuits. The design specifies the nominal thickness of the IC resistance layer to be 100 units. If the thickness strays too far from 100 units’ IC performance may be degraded. Assume the process is in control when 25 samples of IC resistance layer thickness (each of size 4) were taken off the production line. Using the methods of section 11.3.1 Control Charts for Variables, we want to achieve statistical control of the resistance layer thickness using X-bar and R charts.

The 25 sample values are provided in the following table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sample No. | Sample Values | | | |
| 1 | 90.42 | 90.92 | 98.98 | 93.26 |
| 2 | 91.91 | 86.45 | 103.18 | 103.58 |
| 3 | 110.85 | 96.96 | 98.19 | 102.65 |
| 4 | 125.56 | 106.68 | 105.53 | 97.33 |
| 5 | 111.84 | 100.27 | 93.82 | 111.41 |
| 6 | 98.12 | 97.76 | 90.02 | 112.4 |
| 7 | 107.87 | 87.01 | 106.06 | 119.58 |
| 8 | 100.17 | 100.93 | 80.77 | 88.77 |
| 9 | 94.02 | 100.77 | 107.21 | 101.69 |
| 10 | 93.49 | 112.24 | 100.73 | 95.44 |
| 11 | 89 | 91.44 | 104.04 | 98.09 |
| 12 | 94.12 | 93.56 | 95.84 | 102.98 |
| 13 | 107.21 | 86.29 | 97.46 | 122.98 |
| 14 | 95.35 | 100.9 | 106.59 | 100.73 |
| 15 | 101.66 | 109.1 | 92.83 | 86.62 |
| 16 | 103.35 | 80.3 | 117.23 | 93.92 |
| 17 | 103.31 | 94.49 | 115.74 | 103.28 |
| 18 | 103.87 | 118.35 | 111.11 | 91.97 |
| 19 | 106.45 | 105.86 | 108.14 | 97.13 |
| 20 | 89 | 98.45 | 112.17 | 111.68 |
| 21 | 115.88 | 108.87 | 104.21 | 91.71 |
| 22 | 106.19 | 96.96 | 102.49 | 103.81 |
| 23 | 99.48 | 107.25 | 92.07 | 101.53 |
| 24 | 99.35 | 90.06 | 72.8 | 94.88 |
| 25 | 96.87 | 101.96 | 101.92 | 105.49 |

a. Calculate the center line value and control limits for the R-chart.  
*Hint: Center line for the R chart is mean of the ranges.*

b. Calculate the center line value and control limits for the X-bar chart.

c. Can the above control limits be adopted for use in on-line statistical process control? Explain.

d. 12 additional samples of IC resistance layer thickness were collected from a later production run and are provided below. Is the process in-control or out-of-control? Use the Control Charts constructed in parts a and b to determine whether the process is in-control or out-of-control. Explain your answer.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sample No. | Sample Values | | | |
| 1 | 98.46 | 105.39 | 112.11 | 105.16 |
| 2 | 83.26 | 124.86 | 129.63 | 112.92 |
| 3 | 130.74 | 97.72 | 107.69 | 118.21 |
| 4 | 83.9 | 82.79 | 79.36 | 85.87 |
| 5 | 115.22 | 99.81 | 104.54 | 100.94 |
| 6 | 114.76 | 136.91 | 147.56 | 138.03 |
| 7 | 128.38 | 109.39 | 104.58 | 114.89 |
| 8 | 111.95 | 116.33 | 139.89 | 120.6 |
| 9 | 123.52 | 128.46 | 129.76 | 131.34 |
| 10 | 140.41 | 118.69 | 126.35 | 126.99 |
| 11 | 129.16 | 106.52 | 109.77 | 118.24 |
| 12 | 111.21 | 88.04 | 141.47 | 107.52 |