

Math. Methods in Decision Making  
D Term, Sections D01-D02  
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### Decision Making Assignment 4

DUE DATE: Friday, April 20, by 4pm in the course mailbox, SH108.

Please keep in mind that assignments not complying with the course format will be returned without credit.

- 1.) Problem # 7 on page 676
- 2.) Problem # 11 on page 677
- 3.) Problem # 13 on page 678
- 4.) The weekly amount spent for maintenance and repairs in a certain company has an approximately normal distribution with a mean of \$400 and a standard deviation of \$250.
  - (a) If \$ 500 is budgeted to cover repairs for next week, what is the probability that actual costs will exceed the budgeted amount?
  - (b) Suppose you wish to budget for this operation and you want your budgeted amount to be large enough to cover the actual costs at least 95% of the time. What is the least amount you can budget so as to guarantee this?

*Two optional questions are given on the reverse side.*

**(Parts (c) and (d) are Optional, for Extra Credit)**

(c) The company purchases a new piece of equipment which, upon failure, must be replaced at a cost of \$5,000. We assume that this machine will fail in any given week with a probability of 0.001. Find the expected cost and the variance of this random variable.

Partial Solution:

Let us model this phenomenon with the sample space

$$S = \{\text{NO FAILURE}, \text{FAILURE}\}.$$

Probabilities  $p_0 = 0.999$  and  $p_1 = 0.001$  are associated to these two events, respectively. Now the cost  $C$  is a random variable with values  $x_0 = 0$  and  $x_1 = 5000$ .

Then the expected cost is given by  $\mu = \sum_{i=0}^1 p_i x_i$  and the variance is

$$\sigma^2 = E[C^2] - \mu^2 = \left[ \sum_{i=0}^1 p_i x_i^2 \right] - \mu^2$$

(d) We wish to decide how this new component affects our overall mean and standard deviation. Assuming that the distribution in part (a) is a sum of independent distributions similar to the one described in part (c), find the new mean and variance of the overall (normal) distribution. (These quantities are additive.) Re-calculate your answers to parts (a) and (b) for this distribution.