

CE 5710 - Modeling & Simulation

Homework 1

January 18, 2012

Problem 0

Choose your favorite formula and examine the system it models by answering the following questions:

- Identify the abstraction it uses
- What question does it intend to answer?
- Classify the model by examining its underlying syntax and the semantics.
- What is the role and nature of time representation in the model?

The following problems are from Devore (2008)¹.

Problem 1

A company uses 3 different assembly lines - A_1 , A_2 and A_3 - to manufacture a particular component. Of those manufactured by line A_1 , 5% fail, whereas 8% of A_2 's, and 10% of A_3 's components fail. Suppose that 50% of all components are produced by line A_1 , 30% of all components are produced by line A_2 , and 20% of all components come from line A_3 . If a randomly selected component needs rework, what is the probability that it comes from line A_1 ? line A_2 ? and line A_3 .

Problem 2

A consumer organization that evaluates new automobiles customarily reports the number of major defects in each car examined. Let X denote the number of major defects in a randomly selected car of a certain type. The *cumulative distribution function (cdf)* of X is as follows:

$$F(x) = \begin{cases} 0 & x < 0 \\ 0.06 & 0 \leq x < 1 \\ 0.19 & 1 \leq x < 2 \\ 0.39 & 2 \leq x < 3 \\ 0.67 & 3 \leq x < 4 \\ 0.92 & 4 \leq x < 5 \\ 0.97 & 5 \leq x < 6 \\ 1 & 6 \leq x \end{cases}$$

Calculate the following probabilities directly from the cdf:

- $P(X = 2)$

¹Devore, J. (2008). Probability and Statistics for Engineering and the Sciences. Thomson Books, 7th. edition.

- $P(X > 3)$
- $P(2 \leq X \leq 5)$
- $P(2 < X < 5)$

Problem 3

When circuit boards used in the manufacture of compact disc players are tested, the long run percentage of defectives is 5%. Let X = the number of defective boards in a random sample of size $n = 25$, so $X \sim \text{Bin}(25, .05)$. Find:

- $P(1 \leq X \leq 4)$
- Calculate the expected value and standard deviation of X .