STAT 305 D Exam 2

Show all your work.

1. (25 points) Suppose 90% of all students taking a beginning programming course fail to get their first program to run on first submission. Use a binomial distribution and assign probabilities to the possibilities that among a group of six such students,

   (a) (5 points) all fail on their first submissions.

   (b) (5 points) at least four fail on their first submissions

   (c) (5 points) less than four fail on their first submissions.

   Continuing to use this binomial model:

   (d) (5 points) What is the mean number who will fail?

   (e) (5 points) What are the variance and standard deviation of the number who will fail?

2. (20 points) Find $E(X)$ and $\mathrm{Var}(X)$ for a continuous distribution with probability density

$$f(x) = \begin{cases} 0.3 & 0 < x \leq 1 \\ 0.7 & 1 < x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

3. (30 points) Suppose that X is a normal random variable with mean $\mu = 10.2$ and standard deviation $\sigma = 0.7$. Evaluate the following probabilities involving X:

   (a) (3 points) $P(X \leq 10.1)$

   (b) (3 points) $P(X > 10.5)$

   (c) (3 points) $P(9.0 < X < 10.3)$

   (d) (4 points) $P(|X - 10.2| \leq 0.25)$

   (e) (4 points) $P(|X - 10.2| > 1.51)$

   Find numbers # such that the following statements about X are true:

   (f) (4 points) $P(|X - 10.2| < \#) = 0.80$

   (g) (4 points) $P(X < \#) = 0.80$

   (h) (5 points) $P(|X - 10.2| > \#) = 0.04$

4. (25 points) A 10 ft cable is made of 50 strands. Suppose that, individually, 10 ft strands have breaking strengths with mean 45 lb and standard deviation 4 lb. Suppose further that the breaking strength of a cable is roughly the sum of the strengths of the strands that make it up.

   (a) (12 points) Find a plausible mean and standard deviation for the breaking strength of such 10 ft cables.

   (b) (13 points) Evaluate the probability that a 10 ft cable of this type will support a load of 2230 lb. (*Hint*: If $\overline{X}$ is the mean breaking strength of the strands, $\sum(\text{Strengths}) \geq 2230$ is the same as $\overline{X} \geq (\frac{2230}{50})$. Now, use the central limit theorem.)