Name_____

STA 320 Midterm 2

Probability

November 21st, 2008

There are five questions on this test. DO use calculators if you need them. "And then a miracle occurs" is not a valid answer. There will be no bathroom break allowed. Please keep all prayers silent.

You have 50 minutes to complete this test. Please ask me questions if a question needs clarification.

Each question is worth the same number of points.

Question 1: Discrete probability distributions

If one-third of the persons donating blood at a clinic have O^+ blood, find the probability the following events:

(a) The first O^+ donor is the fourth donor of the day.

(b) The second O^+ donor is the fourth donor of the day.

Question 2: Moment generating functions

Find the moment generating function for the Bernoulli random variable.

Question 3: Continuous probability distributions

The number of defective circuit boards among those coming out of a soldering machine follows a Poisson distribution. For a particular 8-hour day, one defective bourd is found.

(a) Find the probability that it was produced during the first hour of operation for that day.

(b) Find the probability that it was produced during the last hour of operation for that day.

Questions 4: Normal distribution

The weekly amount spent for maintenance and repair in a certain company has an approximately normal distribution with a mean of $400 and a standard deviation of $20. If $450 is budget to cover repairs for next week, what is the probability that the actual costs will exceed the budget amount?

Questions 5: Bivariate probability distributions

An environmental engineer measures the amount (by weight) of particular pollution in air sample (of certain volume) collected over the smokestack of a coal-fueled power plant. Let X_1 denote the amount of pollutant per samplestack owhen a certain cleaning device on the stack is not operating and let X_2 denote the amount of pollutant per sample when the cleaning device is operating under similar environmental conditions. It is observed that X_1 is always greater than $2X_2$ and the relative frequency of (X_1, X_2) can be modeled by

$$f(x_1, x_2) = \begin{cases} k & \text{for } 0 \leq x_1 \leq 2,\ 0 \leq x_2 \leq 1,\ 2x_2 \leq x_1 \\ 0 & \text{otherwise.} \end{cases}$$

(a) Find the value of k that makes a probability density function. $B(n, p)$.

(b) Find $P(X_1 \geq 3X_2)$.