

Midterm Exam II

Math 361
9/27/10

Name: _____

Read all of the following information before starting the exam:

- READ EACH OF THE PROBLEMS OF THE EXAM CAREFULLY!
- Show all work, clearly and in order, if you want to get full credit. I reserve the right to take off points if I cannot see how you arrived at your answer (even if your final answer is correct).
- A single $8\frac{1}{2} \times 11$ sheet of notes (double sided) is allowed. Calculators are permitted.
- Circle or otherwise indicate your final answers.
- Please keep your written answers clear, concise and to the point.
- This test has . problems and is worth 100 points. It is your responsibility to make sure that you have all of the pages!
- Turn off cellphones, etc.
- READ EACH OF THE PROBLEMS OF THE EXAM CAREFULLY!
- Good luck!

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1. (*20 points*) Ten cards are drawn without replacement from a deck of 52 cards. X denote the number of red cards and Y denotes the number of clubs.

a. (*7 pts*) Compute the marginal pdf $f_X(x)$

b. (*7 pts*) Compute the joint pdf $f_{X,Y}(x,y)$.

c. (*6 pts*) Compute the conditional pdf $f_{X|Y}(x|y)$.

2. (20 points) X and Y are continuous random variables with $f_{X,Y} = 9e^{-x}y^{-10}$ for $0 < x < \infty$, $1 < y < \infty$ and 0 otherwise. **a.** (10 pts) Compute $\mathbb{E}[X]$, and $\mathbb{E}[XY]$

b. (10 pts) Suppose $Z_1 = X + Y$ and $X_2 = Y$. Find the joint pdf $f_{Z_1,Z_2}(z_1, z_2)$.

- 3.** (20 points) X is a random variable with $\mathbb{E}[X] = 100$ and $\text{Var}(X) = 20$. Let $Y = 10X$.
- a.** (10 pts) Estimate $\mathbb{P}(X < 0 \text{ or } X > 200)$.

- b.** (10 pts) Let $Y = 10X$. Compute $\mathbb{E}[Y]$ and $\text{Var}(Y)$.

4. (20 points) **a.** (10 pts) Suppose X and Y have joint pdf $f(x) = 6xy$ for $0 < x < y < 1$, zero otherwise. Compute the joint moment generating function $M_{X,Y}(t_1, t_2)$. For what t_1, t_2 does this exist?

b. (10 pts) A random variable X has moment generating function $M(t) = \frac{e^t}{2-e^t}$. Compute $\text{Var}(X)$.

5. (*20 points*) We choose a random variable X uniformly in $(0, 1)$ and then a random variable Y uniformly in the interval $(X, 1)$. **a.** (*8 pts*) Find $f_X(x)$ and $f_{Y|X}(y|x)$.

b. (*6 pts*) Find the joint pdf $f_{X,Y}(x, y)$.

c. (*6 pts*) Compute $\mathbb{E}[X|Y = y]$

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