# Practice Midterm 2

Name:

Student ID:

#### Instructions:

- Do not open this exam until instructed to do so.
- You have 50 minutes to complete the exam.
- Please print your name and student ID number above.
- You may not use calculators, books, notes, or any other material to help you. Please make sure your phone is silenced and stowed where you cannot see it.
- Please write your solutions in the space below the problems. We will only grade your work within the pages that are relevant to the problems.
- Each problem is worth the same amount of points. Partial credit will be scarce, so make sure to get everything right.

Please do not write below this line.

Question	Score
1	
2	
3	
4	
5	
Total	

Let X be a continuous random variable having the CDF:

$$F_X(x) = \begin{cases} \frac{x}{\sqrt{x^2 + 5}}, & 0 \le x, \\ 0, & x < 0. \end{cases}$$

Do the following:

- (a) Compute the PDF of X.
- (b) Find P(-1 < X < 2).

The weekly gravel demand X (in tons) follows the exponential distribution with mean  $\theta = 8$ . However, the owner of the gravel pit can produce at most only six tons of gravel per week. Let Y be the tons sold per week by the owner.

- (a) Find the CDF of Y.
- (b) Compute  $P(3 \le Y \le 6)$ .

Every smartphone returned to a repair center is classified according its needed repairs: (1) touchscreen, (2) battery, or (3) other. Past experience shows that 60% of broken smartphones need type 1 repairs, 30% need type 2 repairs, and 10% need type 3 repairs. Let  $X_i$  equal the number of type *i* repairs needed on a day in which four independently broken smartphones are returned.

- (a) Find the probability that  $X_1 = 1$  and  $X_2 = 2$ .
- (b) Find  $E(X_3)$ .

Let X and Y have the joint PDF:

 $f_{X,Y}(x,y) = 2,$  x > 0, y > 0, x + y < 1.

Do the following:

- (a) Compute Cov(X, Y).
- (b) Are X and Y independent? Explain why or why not.

Let X have the uniform distribution over the interval [1, 2], and let Y, given X = x, have the normal distribution  $\mathcal{N}(12x, 2x)$ .

- (a) Compute E(XY).
- (b) Compute Var(Y).

(You may use: the uniform distribution over [a, b] has mean  $\frac{a+b}{2}$  and variance  $\frac{(b-a)^2}{12}$ .)

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