

ECE 302-003, Homework #10

It is a self-exercise. No need to turn in the homework.

<https://engineering.purdue.edu/~chihw/23ECE302F/23ECE302F.html>

Question 106: [Intermediate/Exam Level] Suppose X is a geometric random variable with parameter p . Given $X = x_0$, the conditional probability mass function of Y , $p_{k|X=x_0} = P(Y = k|X = x_0)$, is a Poisson random variable with $\alpha = x_0$.

1. Find the sample space of (X, Y) .
2. What is the joint probability mass function of X and Y ?
3. What is the marginal probability mass function of X ?
4. What is the probability that $P(X^2 + Y^2 \leq 4)$.

Question 107: [Basic] Problem 5.25(b,c). [CCW: 5.25(c) is outside the scope of MT3.]

5.25. The amplitudes of two signals X and Y have joint pdf:

$$f_{X,Y}(x, y) = e^{-x/2}ye^{-y^2} \quad \text{for } x > 0, y > 0.$$

- (a) Find the joint cdf.
- (b) Find $P[X^{1/2} > Y]$.
- (c) Find the marginal pdfs.

Question 108: [Basic] Problem 5.27(a,c,d). [CCW: 5.27(c) is outside the scope of MT3.]

5.27. Let X and Y have joint pdf:

$$f_{X,Y}(x, y) = kx(1 - x)y \quad \text{for } 0 < x < 1, 0 < y < 1.$$

- (a) Find k .
- (b) Find the joint cdf of (X, Y) .
- (c) Find the marginal pdf of X and of Y .
- (d) Find $P[Y < X^{1/2}]$, $P[X < Y]$.

Question 109: [Basic] Problem 5.28. [CCW: 5.28(b) is outside the scope of MT3.]

5.28. The random vector (X, Y) is uniformly distributed (i.e., $f(x, y) = k$) in the regions shown in Fig. P5.1 and zero elsewhere.

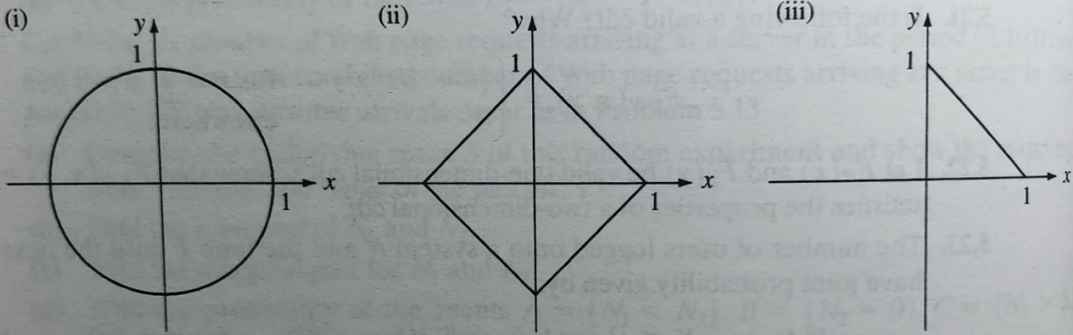


FIGURE P5.1

- (a) Find the value of k in each case.
- (b) Find the marginal pdf for X and for Y in each case.
- (c) Find $P[X > 0, Y > 0]$.