

PRACTICE FINAL EXAM

The material on this exam is covered in Chapters 1-4 in Probability, and Random Processes with Applications to Signal Processing 3rd Edition

by

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1. A binomial random variable X has $P_X(x_k) = b(k;10, p)$. The probability of a success, p , is a uniform random variable $U(0.4,0.5)$. Then $E\{X\}$ is:
a) 4; b) 4.5; c) 5; d) 40; e) 50.
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2. Let $\Theta : U(0, \pi/2)$. Then $E\{\cos(\Theta + \pi/2)\}$ is:
a) 0; b) 0.707; c) $2/\pi$; d) $-2/\pi$; e) -1 .
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3. The joint pdf of two random variables X, Y is given by $f_{XY}(x, y) = xe^{-xy}u(y)$ for $0 \leq x \leq 1$ and $y \geq 0$, and zero otherwise. Then $E\{XY\}$ is given by:
a) 1.0; b) $\ln 3 - \ln 2$; c) 0.5; d) π ; e) $\pi/2$.
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4. Let X, Y be uniform r.v.'s as $X : U[1,3]$ and $Y : U[3,5]$. It is found that $E\{XY\} = 8.1667$. Then the correlation coefficient is given by:
a) 1.0; b) not enough info to compute; c) 0.1667; d) 0.5; e) -0.5.
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5. The joint PMF of X, Y is
 $P_{XY}(0,0) = 1/2, P_{XY}(1,1) = P_{XY}(1,-1) = P_{XY}(-1,1) = P_{XY}(-1,-1) = 1/8$. Then $\text{Var}(X)$ is:
a) 1; b) $3/4$; c) $1/2$; d) $1/4$; e) $1/8$.
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6. A 64 kbit/sec phone line has a bit error rate of 0.001. In observing 10 seconds of data, the expected number of observed errors is:
a) 6400; b) 64; c) 64000; d) 3200; e) 640.
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7. The Sodium 8700 microprocessor chip (SMC) is made at four locations A,B,C,D. The

lifetimes of the chips obey the exponential law i.e., $f_T(t) = \frac{1}{\mu} e^{-\mu t} u(t)$, where

$\mu_A = 2, \mu_B = 1.5, \mu_C = 1, \mu_D = 0.75$ and time is measured in years. The number of chips, N , produced at each location is $N_A = N_B = 1000, N_C = 1500, N_D = 2000$.

The expected lifetime, in years, of a chip chosen at random from a mixture of all these chips is:

- a) 1.18; b) 1.86; c) 1.45; d) 1.05; e) 0.81.
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8. Let $X : N(1,2)$ and let $V : N(0,1)$. Assume that X, V are independent and define

$Y = X + V$. Then the correlation coefficient ρ_{XY} is computed as:

- a) 0.333; b) 0.816; c) 0.408; d) 1.22; e) not enough info to compute.
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9. Let $Z = 3X, W = -2Y$. The joint pdf of X, Y is $f_{XY}(x, y) = \exp[-(x + y)]u(x)u(y)$.

Then the joint pdf $f_{ZW}(1, -1)$ (the first argument is z) is:

- a) 0.072; b) 0; c) 0.606; d) 0.717; e) 0.415.
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10. Let $Z = 2X^2 + 3$ and $X : N(-2,4)$. Then $E\{Z\}$ is:

- a) -1; b) 43; c) 11; d) 15; e) 19.

11. The PMF of X is $P_X(x) = p^x(1-p)^{1-x}$ for $x=0$ or 1 , and $P_X(x) = 0$ elsewhere. The characteristic function of X is:

- a) 1; b) $p(1-p)e^{j\omega}$; c) $pe^{j\omega} - 1$; d) $pe^{j\omega}$; e) $pe^{j\omega} + 1 - p$.
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12. In the previous problem let $p=0.6$. Then the 10th moment of X i.e., $E\{X^{10}\}$ is given by: (Hint: You don't need to get Problem 9 right to get the right answer here)

- a) $(1/0.6)^{10}$; b) $(0.6)^{10}$; c) 0.6; d) 0.24; e) $(0.24)^{10}$.
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