Processes in Engineering	NUMBER ENGR 371	SECTION T,X	
EXAMINATION	DATE	TIME	# OF PAGES
FINAL	April 25, 1995	3 hrs	5
INSTRUCTOR			
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MATERIALS ALLOWED: V NO	YES (PLEASE SPECIFY)		
CALCULATORS ALLOWED: NO	✓ YES		
SPECIAL INSTRUCTIONS:			
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1) Each front tire on a particular type of automobile is supposed to be filled to a pressure of 26psi. Suppose the actual air pressure in each tire is a random variable X for the right tire and Y for the left tire, with joint pdf

$$f(x,y) = \begin{cases} K(x^2+y^2) & 20 < x < 30, \ 20 < y < 30 \\ 0 & \text{otherwise} \end{cases}$$

- i) What is the value of K?
- ii) What is the probability that both tires are underfilled?
- A library employee shelves 1000 books on a particular day. If the probability that any particular book is misshelved is 0.001 and books are shelved independently of one another, calculate the probability that
 - i) At least one book is misshelved on that day.
 - ii) Exactly one book is misshelved during a five-day workweek, assuming that what occurs on any one day is independent of what happens on any other day and 1000 books per day are shelved.

- A particular type of gasoline tank for a compact car is designed to hold 15 gal. Suppose the actual capacity X of a random chosen tank of this type is normally distributed with mean 15 gal and standard deviation 0.2 gal.
 - i) What is the probability that a randomly selected tank will hold between 14.7 and 15.1 gal?
 - ii) If the car on which a randomly chosen tank is mounted gets exactly 25 mile per gal., what is the probability that the car can travel 370 miles without refuelling?
- 4) Two random variables X and Y have a joint probability density function



$$\frac{3}{16}x^{2}y \qquad 0 < x < 2, \quad 0 < y < 2$$

$$f(x,y) = \begin{cases} 0 & \text{elsewhere} \end{cases}$$

Find the probability distribution for W = XY.

5) The breaking strength of a rivet has a mean value of 10,000 psi and a standard deviation of 500 psi.



- i) What is the probability that the sample mean breaking strength for a random sample of 40 rivets is between 9900 and 10,200?
- ii) Assume that 160 independent random samples of size 40 are taken; find the probability that at least 140 of the sample means will fall between 9900 and 10,200.

- Assume that the helium porosity (in percentage) of coal samples taken from any particular seam is normally distributed with a population standard deviation of 0.75.
 - i) Compute a 95% confidence interval for the mean porosity of a certain seam if the average porosity for 20 specimens from the seam is 4.85.
 - How large a sample size is necessary if the length of the 95% confidence interval analogous to that of part i) is to be 0.40?
- 7) Consider the random process,

$$z(t) = t x \cos(wt + \theta)$$

where X is a random variable with mean μ and variance σ^2 . θ is a uniformly distributed random variable in the interval $(0, 2\pi)$ and independent of X.

- i) Determine the autocorrelation function of the process Z(t).
- ii) Determine the variance of the process Z(t).
- iii) Is the process Z(t) stationary, why?

