**King Fahd University of Petroleum & Minerals**

**Serial #**

- 1 points for not writing your serial number

Electrical Engineering Department

EE315: Probabilistic Methods in Electrical Engineering (112)

**Quiz 2: Probability**

Name: KEY

In a communication system the signal sent from point *a* to point *b* arrives by two paths in parallel. Over each path the signal passes through two repeaters (in series). Each repeater in one path has a probability of failing (becoming an open circuit) of 0.005. This probability is 0.008 for each repeater in the other path. All repeaters fail independently of each other. Find the probability that the signal will not arrive at point

*b*.

$$R\_{i}=\left\{relay R\_{i}fails, i=1,2,3,4\right\}=\left\{R\_{i}open\right\}$$

$$P\left(R\_{i}\right)=\left\{\begin{matrix}p\_{1}=0.005&i=1,2\\p\_{2}=0.008&i=3,4\end{matrix}\right.$$

$$P\left(signal does not arrive\right)=P\left\{R\_{1}or R\_{2} open\right)and \left(R\_{3}or R\_{4}\right)opens)\}$$

$=P\left\{\left(R\_{1}∪R\_{2}\right)∩\left(R\_{3}∪R\_{4}\right)\right\}=P\left(R\_{1}∪R\_{2}\right)P\left(R\_{3}∪R\_{4}\right) $independent failures.

$$=[P\left(R\_{1}\right)+P\left(R\_{2}\right)-P\left(R\_{1}∩R\_{2}\right)][P\left(R\_{3}\right)+P\left(R\_{4}\right)-P\left(R\_{3}∩R\_{4}\right)]$$

$$=\left(2p\_{1}-p\_{1}^{2}\right)\left(2p\_{2}-p\_{2}^{2}\right)=\left[0.01-25\left(10^{-6}\right)\right][0.016-64\left(10^{-6}\right)]≈0.00016$$

A production line manufactures 10-liter gasoline cans to a volume tolerance 5%. The probability of any one can being out of tolerance is 0.03. If five cans are selected at random.

What is the probability that they are all out of tolerance?

This is a Bernoulli trials experiment with *N*=5

$$p=P\left( a can is out of tolerance\right)=0.03$$

$$P\left(5 out of tolerance\right)=\left(\begin{matrix}5\\5\end{matrix}\right)\left(0.03\right)^{5}\left(1-0.03\right)^{0}=2.43×10^{-8}$$

What is the probability that exactly two are out of tolerance?

$$P\left(2 out of tolerance\right)=\left(\begin{matrix}5\\2\end{matrix}\right)\left(0.03\right)^{2}\left(1-0.03\right)^{3}=\frac{5!}{\left(2!\right)\left(3!\right)}\left(9×10^{-4}\right)\left(0.91267\right)=8.21403×10^{-3}$$

 Good Luck, **Dr. Ali Muqaibel**