

ECE 361: Probability for Engineers HW # 1, **Due April 9**

1. A random noise measurement shows that the values lie between -15 and 15 V. (a) Define the universal set for this noise voltage (b) What is the set to describe the voltages if the noise is passing through a halfwave rectifier (c) if you add a dc voltage of -5 V, repeat (a) and (b), (d) what is the set that describes power dissipated across a load of $1\ \Omega$ with the new voltage?
2. Using Venn diagrams, show that $\overline{A \cup B} = \overline{A} \cap \overline{B}$ and $\overline{A \cap B} = \overline{A} \cup \overline{B}$
3. Events A and B are such that $p(A)=0.2$, $p(B)=0.3$ and $p(AB)=0.1$. Evaluate the following probabilities $p(\overline{A})$, $p(\overline{B})$, $p(A \cup B)$, $p(\overline{A \cap B})$
4. Using the result $p(A \cup B) = p(A) + p(B) - p(A \cap B)$
Obtain an expression for (A,B, and C are not mutually exclusive) $P(A \cup B \cup C)$
5. If A, B, and C are events such that $A \subset B \subset C$, what are the probabilities of $A \cup B \cup C$ and $A \cap B \cap C$. How would you express these probabilities if $A \supset B \supset C$?
6. An integer number is chosen randomly between 1 and 1000. What is the probability that the number picked is divisible by either 4 or 5 or both.
7. The sample space consists of 10 equally likely events $S=\{z_1, z_2, \dots, z_{10}\}$. If $A=\{z_1, z_5, z_9\}$, $B=\{z_1, z_2, z_6, z_9\}$, $C=\{z_6, z_9\}$, find $P(A \cup C)$, $P(B \cup \overline{C})$, $P[A \cap (B \cup C)]$, $P(\overline{A \cup B})$, $P[A \cup (B \cap C)]$
8. In a certain city, 75% of the residents jog (J), 20% like ice cream (I) and 40% enjoy music (M). If 15% of the people jog and like ice cream, 30% jog and enjoy music, 10% like ice cream and music and 5% do all three, find the probability that (a) a resident will engage in at least one of the three activities (b) a resident engages in precisely one type of activity.
9. A random number generator is providing numbers between 0 and 20, expressed as $S=\{x|0 \leq x < 20\}$. If two new sets are created as $A=\{x|2 \leq x < 10\}$ and $B=\{x|x > 8\}$, obtain the following sets, Obtain $A \cup B$, $A \cap B$, $\overline{A \cap B}$.
10. Two numbers x and Y are selected at random between 0 and 1. Three events are defined in terms of the following outcomes: $A=\{x > 1/2\}$; $B=\{y > 1/2\}$ and $C=\{x > y\}$. Determine (a) if A and B are independent (b) A and C are independent.
11. You are tossing a coin. Using random number generation, obtain a plot of the probability of getting H or T when the $p(H)$ varies from 0.1 to 0.95 continuously.
12. A biased die is such that 1 appears 6 times, 2 appears 5 times, 3 appears 4 times, 4 appears 3 times, 5 appears 2 times as the appearance of 6. Create a histogram of these probabilities and compare them to that of a fair die by generating a million random numbers.