Date Completed: _____
Mentor Initials: _____

Probability & Counting (Advanced)

1. For all positive integers a and b, the expression $(a^b)!$ is equivalent to one of the following expressions. Which one?

A. $(a!)^b$
B. $(ab)!$
C. $b(a!)$
D. $a^b(-1-2-3\ldots..)$
E. $[a^b(a^b-1)(a^b-2)(a^b-3)\ldots..(1)]$

2. Five balls numbered $1, 2, 3, 4,$ and 5 are placed in a bin. Two balls are drawn at random without replacement. What is the probability that the sum of the numbers on the balls drawn is 6?

A. $\frac{1}{5}$
B. $\frac{2}{5}$
C. $\frac{4}{5}$
D. $\frac{5}{9}$
E. $\frac{4}{25}$

3. Clayton and Zella are members of a school committee that will be meeting this afternoon. The 7 members will be seated in 7 chairs in a circle. If seats are assigned randomly, what is the probability that Clayton and Zella will NOT be seated next to each other?

A. $\frac{1}{3}$
B. $\frac{2}{3}$
C. $\frac{1}{6}$
D. $\frac{5}{6}$
E. $\frac{1}{2}$

4. For the first 6 values of x, the table below gives the probability, $P(x)$, that a certain factory machine will make x errors on any given workday.

x errors	$P(x)$
0	0.0745
1	0.1111
2	0.2398
3	0.2264
4	0.2003
5	0.1175

Which of the following values is closest to the probability that this machine will make at least 2 errors on any given workday?

A. 0.2398
B. 0.4582
C. 0.6443
D. 0.7840
E. 0.8144

5. A fair spinner with 5 equally sized regions and an arrow has regions numbered $1, 2, 3, 4,$ and 5, respectively, and a second fair spinner with 6 equally sized regions numbered $1, 2, 3, 4, 5,$ and 6, respectively. The arrows are both spun at the same time, and the numbers the 2 arrows land on are multiplied together. What is the probability that this product is an even number?

A. $\frac{1}{2}$
B. $\frac{3}{8}$
C. $\frac{3}{9}$
D. $\frac{7}{10}$
E. $\frac{9}{10}$

6. Let G and H be independent events. Denote $P(G)$ as the probability that Event G will occur, and denote $P(G \cap H)$ as the probability that Events G *and* H will both occur. Which of the following equations *must* be true?

A. $P(G) = P(H)$
B. $P(G) = 1 - P(H)$
C. $P(G \cap H) = P(G) + P(H)$
D. $P(G \cap H) = P(G) \cdot P(H)$
E. $P(G \cap H) = P(G) + P(H) - P(G) \cdot P(H)$

7. A committee of 8 will be selected from a group of 8 women and 6 men. What of the following equations would compute the probability that the committee consisted of 4 women and 4 men?

A. ${}_8C_4$
B. ${}_8C_6$
C. ${}_8C_4 + {}_6C_4$
D. $\frac{{}_8C_4 \times {}_6C_4}{{}_{14}C_8}$
E. $\frac{{}_8C_4 + {}_6C_4}{{}_{14}C_8}$

8. Which of the following expressions give the number of distinct permutations of the letters in HIERARCHY ?

A. 9!
B. 5! (5!)
C. $\frac{9!}{4!}$
D. $\frac{9!}{2!}$
E. $\frac{9!}{(2!)(2!)}$

9. A business is choosing a committee of 6 people from the company and wishes to ensure that it consists of 3 women and 3 men. If there are 22 women and 24 men currently employed in the company, how many different committees could be chosen?

A. 528
B. 3,168
C. 3,116,960
D. 9,366,819
E. 112,210,560

10. Of the 18 balloons in a party store, 5 are red, 3 are blue, 4 are green, and 6 are purple. Jose will buy 4 balloons, chosen at random, for his daughter's birthday party. What is the probability that Jose will rent 1 of each of the 4 colors of balloons?

A. $\frac{1}{204}$
B. $\frac{1}{18}$
C. $\frac{2}{17}$
D. $\frac{2}{9}$
E. $\frac{1}{4}$