

**Question 1**

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How many arrangements are there of the letters in the word MATCH?

Are repetitions allowed? **no**

Does order matter? **yes**

What is  $n$ ? **5**

What is  $r$ ? **5**

Equation to use?  $P(n, r)$  /  $C(n, r)$  /  $n^r$  /  $C(r + n - 1, r)$   **$P(n, r)$**

Solution:  **$P(5, 5) = 120$**

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**Question 2**

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There are five red, three green, and eight blue marbles in a box. In how many ways can a sample of four be selected?

Are repetitions allowed? **yes**

Does order matter? **no**

What is  $n$ ?  **$5 + 3 + 8 = 16$**

What is  $r$ ? **4**

Equation to use?  $P(n, r)$  /  $C(n, r)$  /  $n^r$  /  $C(r + n - 1, r)$   **$C(n, r)$**

Solution:  **$C(16, 4) = 1820$**

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**Question 3**

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We can choose from four types of muffins: Blueberry, Orange, Chocolate Chip, or Cream Cheese. You're going to select muffins in this order: First for yourself, second for your sister, and third for your brother. It is OK if several people have the same muffin type.

Are repetitions allowed? **yes**

Does order matter? **yes**

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What is  $n$ ? 4

What is  $r$ ? 3

Equation to use?  $P(n, r) / C(n, r) / n^r / C(r + n - 1, r)$   $n^r$

Solution:  $4^3$

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#### Question 4

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How many bags of 20 pieces of candy can one buy from a store that sells four types of candy?

Are repetitions allowed? yes

Does order matter? no

What is  $n$ ? 20

What is  $r$ ? 4

Equation to use?  $P(n, r) / C(n, r) / n^r / C(r + n - 1, r)$   $C(r + n - 1, r)$

Solution:  $C(20 + 4 - 1, 20) = C(23, 20)$

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## 6.1 Introduction

### 6.1.1 Experiments, Outcomes, and Events

#### Question 5

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Finish the following table to log all possible equally-likely outcomes for rolling a red four-sided die and a green four-sided die.

	Green 1	Green 2	Green 3	Green 4
Red 1	(1, 1)	(1, 2)	(1, 3)	(1, 4)
Red 2	(2, 1)	(2, 2)	(2, 3)	(2, 4)
Red 3	(3, 1)	(3, 2)	(3, 3)	(3, 4)
Red 4	(4, 1)	(4, 2)	(4, 3)	(4, 4)

Using the definition above describe the following:

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- a. Both the red and green dice have the same values.

$$n(E) = 4 \quad n(S) = 16 \quad \text{Prob}(E) = \frac{4}{16} = \frac{1}{4}$$

- b. The sum of both dice values is 4.

$$n(E) = 3 \quad n(S) = 16 \quad \text{Prob}(E) = \frac{3}{16}$$

### Question 6

\_\_\_\_\_ / 3

Consider the experiment of drawing two cards from the top of a standard deck of 52 cards, and the event  $E$  of the two cards having the same value.<sup>1</sup>

- a. Describe the set  $S$  of all outcomes, represented so that they are equally likely.

$$n(S) = P(52, 2).$$

- b. Describe the event  $E$  in terms of your representation.

$$n(E) = (52)(3)$$

- c. Compute  $\text{Prob}(E) = \frac{n(E)}{n(S)}$ .

$$\text{Prob}(E) = \frac{n(E)}{n(S)} = \frac{(52)(3)}{(52)(51)}$$

### Question 7

\_\_\_\_\_ / 3

Consider the experiment of tossing a coin five successive times, and the event  $E$  that the last two tosses have the same result.

( \_ \_ \_ Heads Heads ) OR ( \_ \_ \_ Tails Tails )

- a. Describe the set  $S$  of all outcomes, represented so they are equally likely

Ordered lists of length 5 with entries from  $\{H, T\}$

- b. Describe the event  $E$  in terms of your representation.

$$n(S) = 2^5 = 32 \quad n(E) = 2^3 \cdot 1 \cdot 1 + 2^3 \cdot 1 \cdot 1 = 16$$

- c.  $\text{Prob}(E) = \frac{n(E)}{n(S)} = \frac{16}{32} = 0.5$

<sup>1</sup>From Discrete Mathematics by Ensley and Crawley

### 6.1.2 The complement of the Event

**Question 8**

\_\_\_\_\_ / 3

What is the probability that for a six-sided die rolled three times the same result comes up more than once?

- What is the sample space  $S$ ?  $\{1, 2, 3, 4, 5, 6\}$
- What is the event  $E$  (in English)?  
The set of outcomes that... use the same # more than once.
- What is the complement of  $\bar{E}$  (in English)?  
The set of outcomes that... are all different numbers.
- What *structure type* is  $\bar{E}$ ? What is  $n$  and  $r$ ?  
Permutation,  $n = 6$ ,  $r = 3$
- Calculate  $Prob(\bar{E})$   
 $Prob(\bar{E}) = n(\bar{E})/n(S) = \frac{P(6,3)}{6^3} = \frac{5}{9} = 0.\bar{5}$
- Calculate the probability for the Event  $Prob(E)$  using the proposition.  
 $1 - Prob(\bar{E}) = 1 - 0.55 \approx 0.44$