

**Instructions**

- This is a practice exam. It is due **March 10**.
- The actual exam will be on **Thursday March 12**.
- The formula sheet will be provided on the actual exam.
- Enjoy!

## Formulas

### Discrete Probability Distributions

$$\mu = \sum x \cdot \Pr(x)$$
$$\sigma = \sqrt{(x - \mu)^2 \cdot \Pr(x)}$$

### Factorial

$$0! = 1$$
$$1! = 1$$
$$2! = 2 \cdot 1$$
$$3! = 3 \cdot 2 \cdot 1$$
$$n! = n \cdot (n - 1) \cdot (n - 2) \cdots 3 \cdot 2 \cdot 1$$

### Combinatorics

$${}_nP_x = \frac{n!}{(n - x)!}$$
$${}_nC_x = \frac{n!}{(n - x)! \cdot x!}$$

### Binomial Distributions

$n$  = number of trials

$p$  = chance of success on each trial

$q$  = chance of not succeeding on each trial

$X$  = random variable representing the (unknown) number of successes

$x$  = a specific number of successes

$$q = 1 - p$$

$$\Pr(x) = {}_nC_x \cdot p^x \cdot q^{n-x}$$

$$\mu = np$$
$$\sigma = \sqrt{npq}$$

**Question 1 (20 pts)**

A large vessel contains marbles. Each marble has a pattern and a color. The frequencies are shown in the two-way table below.

	red	yellow	blue	violet	total
checkered	25	6	15	9	55
dotted	12	11	14	20	57
striped	30	2	27	29	88
total	67	19	56	58	200

- a. What is probability a randomly selected marble is checkered?

$$\Pr(\text{checkered}) =$$

- b. What is the probability a randomly selected marble is blue?

$$\Pr(\text{blue}) =$$

- c. If you know a randomly selected marble is checkered, then what is the probability it is blue?

$$\Pr(\text{blue GIVEN checkered}) =$$

- d. What is the probability a randomly selected marble is checkered and blue?

$$\Pr(\text{checkered AND blue}) =$$

- e. What is the probability a randomly selected marble is checkered or blue?

$$\Pr(\text{checkered OR blue}) =$$

- f. Is a red marble or a violet marble more likely to be striped?

$$\Pr(\text{striped GIVEN red}) =$$

$$\Pr(\text{striped GIVEN violet}) =$$

Choose one:

☐ red

☐ violet

**Question 2 (20 pts)**

A spinner has the probability distribution shown below.

$x$	$\Pr(x)$	$x \cdot \Pr(x)$	$x - \mu$	$(x - \mu)^2$	$(x - \mu)^2 \cdot \Pr(x)$
2	0.1				
17	0.47				
18	0.08				
25	0.29				
27	0.06				
		$\mu =$			$\sigma^2 =$ $\sigma =$

- What is the probability of spinning 18?
- What is the probability of spinning 2 or 27?
- If spinning twice, what is the probability of first spinning 2 and then spinning 27?
- What is the probability of spinning at most 18?
- Determine the mean of the discrete probability distribution.
- Determine the standard deviation of the discrete probability distribution.

**Question 3 (5 pts)**

Joann will pick an appetizer and a main course. The possible appetizers and main courses are listed below.

appetizers	main courses
soup	burger
salad	pasta
chips	stirfry
	tacos

a. Draw a **tree diagram** showing the possibilities.

b. How many possibilities are there?

**Question 4 (5 pts)**

Joshua will pick an appetizer, a main course, and a dessert. The options are listed below.

appetizers	main courses	desserts
soup	burger	cake
salad	pasta	cookies
hummus	stirfry	pie
	tacos	
	sushi	

How many possibilities are there for Joshua? (Do not make a tree!)

**Question 5 (10 pts)**

Jan will paint 4 different rooms different colors. There are 9 colors to choose from. How many options does Jan have for how the apartment will be painted?

**Question 6 (10 pts)**

Karl will select 4 toppings for his pizza. There are 12 different toppings available. How many different pizzas are possible?

**Question 7 (20 pts)**

When Emmaline is shooting archery, each arrow has an 70% chance of hitting the bullseye. Emmaline will shoot 12 arrows. We are interested in how many bullseyes Emmaline will hit.

- a. Identify the parameters.

$$n = \qquad p = \qquad q =$$

- b. What is the probability that Emmaline hits the bullseye 9 times?

$$\Pr(9) =$$

- c. What is the probability that Emmaline hits the bullseye at least 10 times?

$$\Pr(X \geq 10) =$$

- d. What is the probability that Emmaline hits the bullseye fewer than 9 times?

$$\Pr(X < 9) =$$

- e. What is the expected value of this binomial distribution?

$$\mu =$$

- f. What is the standard deviation of this binomial distribution?

$$\sigma =$$

**Question 8 (10 pts)**

In a game, there is a 30% chance Bob will win. If Bob wins, there is an 60% chance he is happy. If Bob does **not** win, there is a 20% chance he is happy. After playing the game, Bob is **not** happy; what is the probability that Bob won the game?



a. What is the probability that Candice wins both matches?

b. What is the probability that Candice loses both matches? (Assume ties are impossible such that Candice either wins or loses each match.)

c. What is the probability that Candice wins once and loses once (in either order)?