

MTH 140: Practice Exam 3

1. In a given semester, a small college offers 3 different Mathematics courses, 5 different Science courses, and 4 different History courses. If a student must take one of each, how many different ways can this be done?
 - A. 12
 - B. 16
 - C. 60
 - D. 120
2. Evaluate $14P_2$
 - A. 7
 - B. 182
 - C. 91
 - D. 43,589,145,600
3. Evaluate $8C_4$
 - A. 8
 - B. 1680
 - C. 336
 - D. none of these
4. The library is to be given 5 books as a gift. The books will be selected from a list of 21 titles. If each book selected must have a different title, how many possible selections are there?
 - A. 20,349
 - B. $4.257578514 \times 10^{17}$
 - C. $5.109094217 \times 10^{19}$
 - D. 2,441,880
5. Of the 2,598,960 different five-card poker hands possible from a deck of 52 playing cards, how many would contain all black cards?
 - A. 32,890 hands
 - B. 263,120 hands
 - C. 131,560 hands
 - D. 65,780 hands

6. The table shows the distribution of family size in a certain U.S. city:

Family Size	Probability
2	0.432
3	0.223
4	0.199
5	0.090
6	0.036
7	0.020

(a) Does the table represent a probability distribution?

yes

(b) A family is selected at random from the city. Find the probability that the size of the family is between 2 and 5 inclusive.

A. 0.522

B. 0.944

C. 0.422

D. 0.854

(c) What is the expected value of the family size?

3

7. A student takes a 5 question multiple choice quiz with 4 choices for each question. If the student guesses at random on each question, what is the probability that the student gets

(a) exactly 3 questions correct?

A. 0.022

B. 0.066

C. 0.088

D. 0.176

(b) gets no questions correctly?

0.237

8. In a certain college, 33% of the physics majors belong to ethnic minorities. 10 students are selected at random from the physics majors.

1. Is this a binomial experiment?

yes $p = 0.33$ $n = 10$

2. Find the probability that **exactly** 3 of them belong to an ethnic minority?

$$P(X=3) = \text{binomialpdf}(10, 0.33, 3) = 0.261$$

3. Find the probability that **at most** 7 of them belong to an ethnic minority?

$$P(X \leq 7) = \text{binomialcdf}(10, 0.33, 7) = 0.997$$

4. Find the probability that **at least** 6 of them belong to an ethnic minority?

$$P(X \geq 6) = 1 - \text{binomialcdf}(10, 0.33, 5) = 0.073$$

5. Find the probability that **more than** 2 of them belong to an ethnic minority?

$$P(X > 2) = 1 - \text{binomialcdf}(10, 0.33, 2) = 0.693$$

6. Find the probability that **less than** 5 of them belong to an ethnic minority?

$$P(X < 5) = \text{binomialcdf}(10, 0.33, 4) = 0.794$$

7. How many adult physics majors do you **expect** to belong to an ethnic minority?

$$E(X) = np = (33\%)(10) = 3.3 \text{ adults}$$

9. Let $U = \{1, 2, 4, 5, a, b, c, d, e\}$. Find the complement of the set $Q = \{2, 4, b, d\}$.

A. $\{1, 3, 5, a, c, e\}$

☒ B. $\{1, 5, a, c, e\}$

C. $\{1, 5, a, e\}$

D. $\{1, 2, 4, 5, a, b, c, d, e\}$

10. Let $U = \{q, r, s, t, u, v, w, x, y, z\}$

$$A = \{q, s, u, w, y\}$$

$$B = \{q, s, y, z\}$$

$$C = \{v, w, x, y, z\}$$

List the elements in the set $A \cup B$

☒ A. $\{q, s, u, w, y, z\}$

B. $\{q, s, y\}$

C. $\{q, s, t, u, v, w, x, y, z\}$

D. $\{s, u, w\}$

$$A \cup B = \{q, s, u, y, w, z\}$$

$$(A \cup B)^c = \{r, t, v, x\}$$

$$C^c = \{q, r, s, t, u\}$$

11. Using the same sets as above, list the elements in the set $(A \cup B)^c \cap C^c$

- A. $\{v, w, x, y\}$
- B. $\{q, r, s, t, u, z\}$
- C. $\{c\}$
- D. $\{q, r, s, t, u\}$

c) $\{r, t\}$

12. List the elements in the set $\{x \mid x \text{ is a whole number between 1 and 5}\}$

- A. $\{1, 2, 3, 4, 5\}$
- ☒ B. $\{2, 3, 4\}$
- C. $\{2, 3, 4, 5\}$
- D. $\{1, 2, 3, 4\}$

13. Complete the blank with either $\in$, $\notin$ or $\subseteq$, $\not\subseteq$ to make the statement true.

(a)

$$8 \underline{\in} \{5, 6, 7, 8, 9\}$$

(b)

$$10 \underline{\notin} \{5, 6, 7, 8, 9\}$$

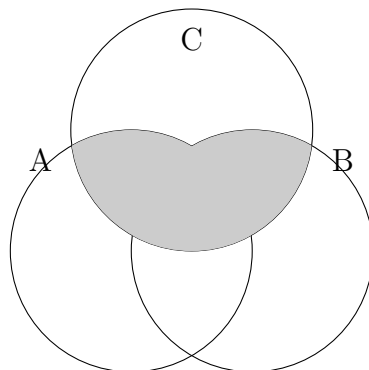
(c)

$$\{4, 5, 8\} \underline{\not\subseteq} \{5, 6, 7, 8, 9\}$$

(d)

$$\{5, 8\} \underline{\subseteq} \{5, 6, 7, 8, 9\}$$

14. The shaded region in the Venn diagram represents which of the following?



- ☒ A. $(A \cup B) \cap C$
- B. $A \cap B \cap C$
- C. $(A \cap B) \setminus C$
- D. $(A \cap C) \cup (B \setminus C)$

15. How many rows must be in the truth table for a statement with 4 variables?

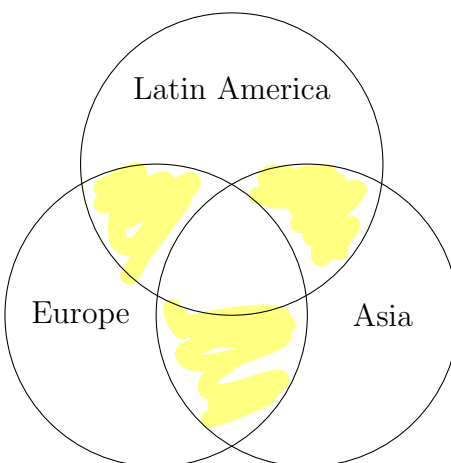
16

16. In a survey of 280 people, a travel company asked people about places they plan to visit in the next 5 years. The results were as follows:

- 48 plan to visit Europe
- 58 plan to visit Latin America
- 34 plan to visit Asia
- 14 plan to visit Europe and Latin America
- 12 plan to visit Latin America and Asia
- 11 plan to visit Europe and Asia
- 4 plan to visit all three

How many people plan to visit exactly two of these places?

25



17. Let A and B be finite sets. Determine whether the following statement is true or false. Here $n(A)$ means cardinality.

$$n(A \cup B) = n(A) + n(B)$$

A. True

☒ B. False

18. Use De Morgan's laws to write a statement that is equivalent to: "It is not true that Napoleon Bonaparte was a rock star or a nurse."

☒ A. Napoleon Bonaparte was neither a rock star or a nurse.

B. Napoleon Bonaparte was not a rock star or was not a nurse.

C. It is not true that Napoleon Bonaparte was not a rock star or not a nurse.

D. Napoleon Bonaparte was either a rock star or a nurse.

19. Write the negation of the statement: "Some reptiles are snakes."

- A. Not all reptiles are snakes.
- ☒ B. No reptiles are snakes.
- C. All snakes are reptiles.
- D. All reptiles are snakes.

Handwritten: All reptiles are not snakes.
Same as: No reptiles are snakes

20. Write the negation of the statement: "Some flowers are not roses."

- A. All flowers are not roses.
- ☒ B. All flowers are roses.
- C. No roses are flowers.
- D. Some flowers are roses.

Handwritten: All flowers are roses.

21. Determine whether the statement is true or false:

" $9 + 2 = 19$ and Canada is in North America"

- A. True
- ☒ B. False

22. Construct a truth table for the statement: $\sim p \vee \sim q$

$\sim p$	p	q	$\sim p$	$\sim p \vee \sim q$
F	T	T	F	F
T	T	F	F	T
F	F	T	T	T
T	F	F	T	T

Given an example of an equivalent statement to $\sim p \vee \sim q$. yes $\sim(p \wedge q)$.

23. Construct a truth table for the statement: $\sim(p \wedge q) \wedge \sim p$

$\sim p$	p	q	$p \wedge q$	$\sim(p \wedge q)$	$\sim(p \wedge q) \wedge \sim p$
F	T	T	T	F	F
F	T	F	F	T	F
T	F	T	F	T	T
T	F	F	F	T	T

24. Construct a truth table for the statement: $((\sim p \wedge q) \wedge (r \vee \sim q))$. Identify any tautologies or contradictions in the table.

$\sim p$	$\sim q$	p	q	r	$\sim p \wedge q$	$r \vee \sim q$	$((\sim p \wedge q) \wedge (r \vee \sim q))$
T	T	T	T	T	F	F	F
T	T	T	T	F	F	F	F
T	T	T	F	T	F	T	F
T	T	T	F	F	F	F	F
T	F	T	T	T	T	T	T
T	F	T	T	F	T	F	F
T	F	F	T	T	F	T	F
T	F	F	T	F	F	F	F
T	T	F	F	T	F	T	F
T	T	F	F	F	F	F	F