

Math 112 - Test 1
September 15, 2016

Name key Score _____

Show all work. Supply explanations when necessary. Partial credit will be awarded for correct work.

1. (3 points) Let A be the set of letters of the word *MISSISSIPPI*. Write A in roster notation.

$$A = \{m, i, s, p\}$$

2. (3 points) Explain why the set of all funny people is not well defined.

BECAUSE IT IS NOT PERFECTLY CLEAR WHAT "FUNNY" MEANS,
WE REALLY CAN'T TELL WHICH PEOPLE ARE IN THIS SET.

3. (16 points) Let $A = \{0, 1, 5, 6, 8, 9\}$ and $B = \{0, 3, 5, 6, 9\}$, and consider A and B as subsets of the universal set $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$. Determine each of the following.

(a) $n(B) = 5$

(b) $A' = \{2, 3, 4, 7\}$

(c) $A \cup B = \{0, 1, 3, 5, 6, 8, 9\}$

(d) $A \cap B = \{0, 5, 6, 9\}$

(e) $(A \cap B)' = \{1, 2, 3, 4, 7, 8\}$

(f) $A' \cup B' = \{1, 2, 3, 4, 7, 8\}$

(g) $B \cap \emptyset = \emptyset$

(h) $B - A = \{3\}$

SAME
THING!

4. (1 point) For which one of these sets is it true that $n(A) = 1$?

(a) $A = \emptyset$

(b) $A = \{0, 1\}$

(c) $A = \{\emptyset\}$

(d) $A = \{1, 11, 111, 1111, \dots\}$

5. (1 point) Let $Z = \{a, b, c\}$. Which one of these sets is NOT a proper subset of Z ?

(a) \emptyset

(b) $\{a\}$

(c) $\{a, b\}$

(d) $\{a, b, c\}$

6. (1 point) Which one of the following sets is NOT empty?

(a) $\{ \}$

(b) The set of all natural numbers less than 1

(c) \emptyset

(d) $\{\emptyset\}$

7. (1 point) Which one of the statements below would be read "x is an element of A?"

(a) $x \subseteq A$

(b) $x \in A$

(c) $x \sim A$

(d) $\{x | x \in A\}$

8. (1 point) Let $A = \{1, 2, 3\}$. How many subsets does A have?

(a) 3

(b) 6

(c) 7

(d) 8

$$2^3 = 8$$

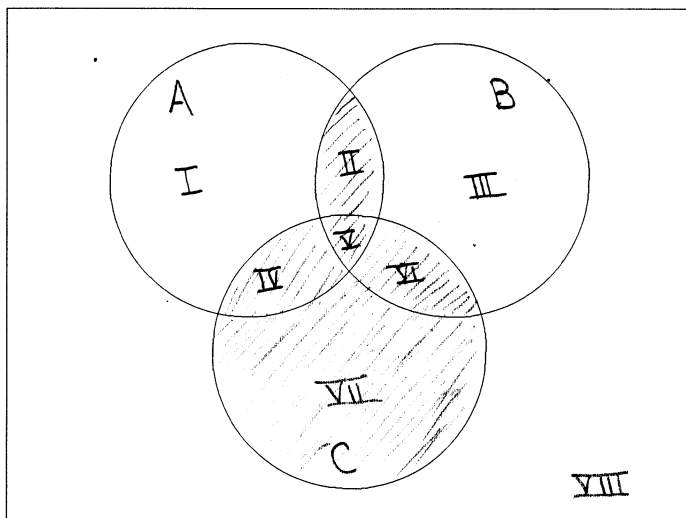
9. (4 points) Rewrite the set S in roster notation.

$$S = \{x \mid x \in \mathbb{N} \text{ and } 1 \leq x < 7\}$$

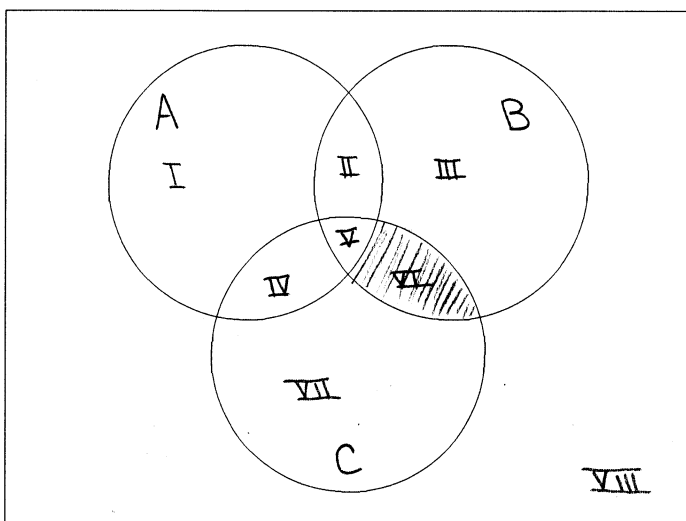
$$S = \{1, 2, 3, 4, 5, 6\}$$

10. (10 points) Shade the region corresponding to each set. Show work or explain your reasoning.

$$(a) (A \cap B) \cup C = \{II, V\} \cup C = \{II, IV, V, VI, VII\}$$



$$(b) (A' \cap B) \cap C = \{III, VI\} \cap C = \{VI\}$$



11. (4 points) List all subsets of $\{1, 2\}$.

$\emptyset, \{1\}, \{2\}, \{1, 2\}$

12. (5 points) Let $A = \{a, b, c, d, e\}$ and let $B = \{b, d, f, h\}$. Determine whether each statement below is true or false.

(a) $\emptyset \subseteq A$ True, \emptyset IS A SUBSET OF EVERY SET

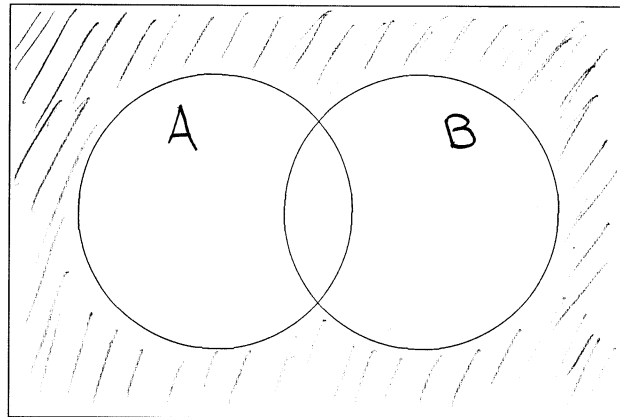
(b) $h \in (A \cap B)$ FALSE, $A \cap B = \{b, d\}$

(c) $n(A \cup B) = 7$ True $A \cup B = \{a, b, c, d, e, f, h\}$

(d) $b \subset B$ FALSE $b \in B$

(e) $b \in A$ True

13. (4 points) Shade the region corresponding $(A \cup B)'$. Show work or explain your reasoning.



$(A \cup B)'$

= EVERYTHING
OUTSIDE
THE UNION

14. (4 points) The set B is defined below using set-builder notation.

$$B = \{x \mid x \in \mathbb{N} \text{ and } 17 \leq x \leq 20\} = \{17, 18, 19, 20\}$$

- (a) What is the cardinality of B ?

4

- (b) Give an example of a set that is equivalent to B , but not equal to B .

$$\{a, b, c, d\}$$

15. (4 points) Suppose U is the set of all U.S. presidents, and A is the subset of living presidents. Using words, describe the elements of A' .

THE ELEMENTS OF A' ARE
THE DECEASED PRESIDENTS.

16. (2 points) Determine a way to describe the set $U = \{b, e, t, r\}$ verbally. (Use only words.)

$U =$ SET OF LETTERS OF
THE WORD "BETTER"

17. (2 points) It is not difficult to show that a set with n elements has 2^n subsets. Using this idea, how many subsets does $\{a, b, c, d, e, f\}$ have?

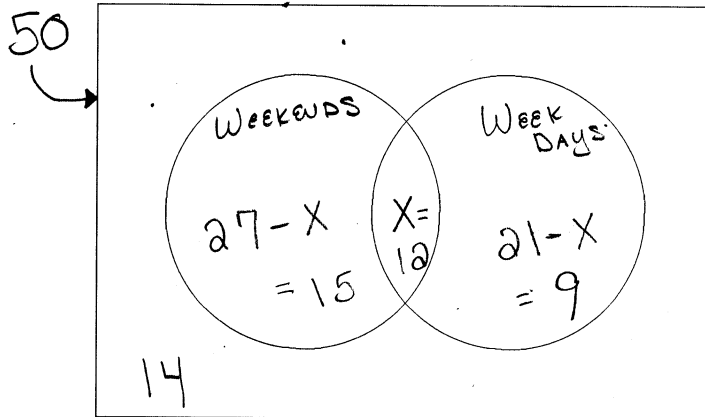
6 ELEMENTS

$$\Rightarrow 2^6 = 64 \text{ SUBSETS}$$

18. (10 points) The following information was obtained from a survey of 50 college students.

- 27 studied on weekends
- 21 studied on weekdays
- 14 never studied

(a) Completely fill in an appropriate Venn diagram. Label your diagram with this problem number.



$$\begin{aligned} 50 &= 27 - X + X + 21 - X + 14 \\ &= 62 - X \\ &\Rightarrow X = 12 \end{aligned}$$

(b) How many students studied on both weekends and weekdays?

12

(c) How many students studied on weekends only?

15

19. (4 points) Rewrite each of the following statements using mathematical symbols.

(a) The set D is equivalent to the set E .

$$D \cong E$$

(b) The cardinality of the union of the two sets P and Q is 13.

$$n(P \cup Q) = 13$$

(c) The set F is a subset of the empty set.

$$F \subseteq \emptyset$$

(d) The number 4 is an element of the set A .

$$4 \in A$$

20. (6 points) Let X be the set of letters of the word *racecar* and let $Y = \{a, b\}$.

(a) Determine the Cartesian product $Y \times X$.

$$X = \{r, a, c, e\}$$

$$Y = \{a, b\}$$

$$Y \times X = \{(a, r), (a, a), (a, c), (a, e), (b, r), (b, a), (b, c), (b, e)\}$$

(b) Determine the difference $Y - X$.

$$Y - X = \{b\}$$

21. (4 points) Let U be the set of all natural numbers and let $A = \{4, 6, 8, 10, 12, 14, \dots\}$. Determine the set A' .

$$A = \{1, 2, 3, 5, 7, 9, \dots\}$$

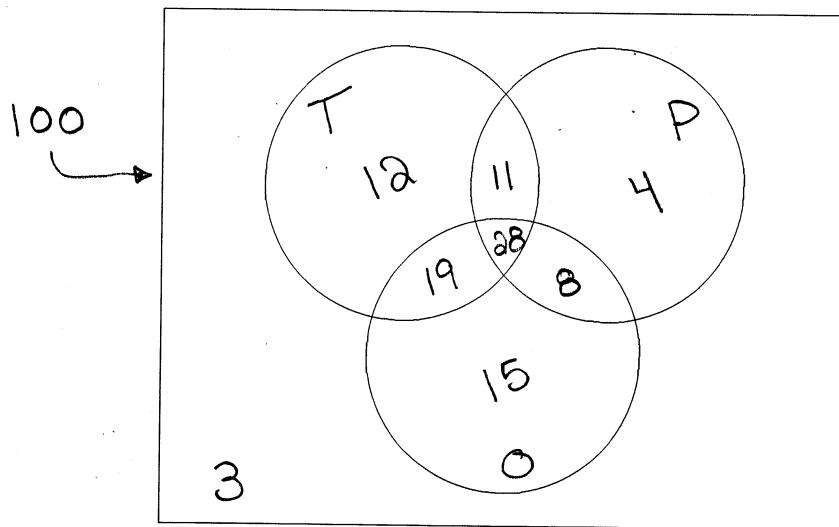
= All odd natural #'s

Along with 2

22. (10 points) One hundred professionals were asked how they obtained their daily news. Here are the results:

- 70 got their news from television or radio (T)
- 51 got their news from print materials such as newspapers or magazines (P)
- 70 got their news from online sources (O)
- 47 got their news from both T and O
- 39 got their news from both T and P
- 36 got their news from both P and O
- 28 got their news from all three T, O, and P

(a) Count and sort these results using a three-set Venn diagram.



$$12 + 11 + 4 + 19 + 28 + 8 + 15 = 97$$

$$100 - 97 = 3$$

(b) How many professionals did NOT get their daily news from any of these three sources?