Math 112 - Final Exam

May 14, 2018

Name _____

Score _____

Show all work to receive full credit. Supply explanations where necessary.

1. (6 points) Let T be the set of letters of the word *thinking*.

   (a) Write T in roster notation.

   (b) What is the cardinality of T?

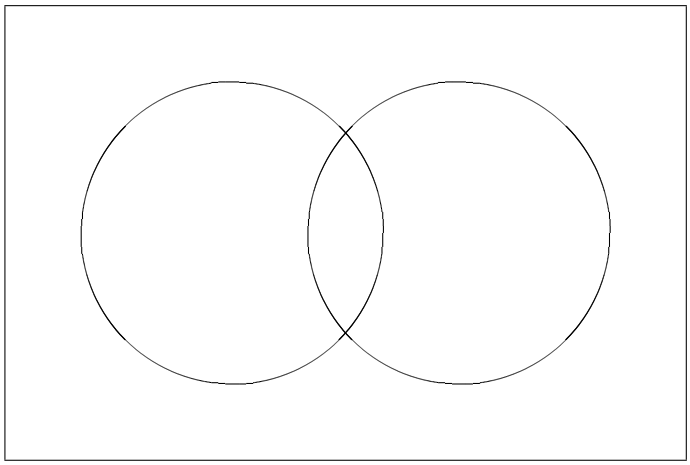
   (c) Give an example of a set that is equivalent to T, but not equal to T.

2. (4 points) Consider the set $M = \{10, 20, 30, 40, \dots\}$.

   (a) Write M in set-builder notation.

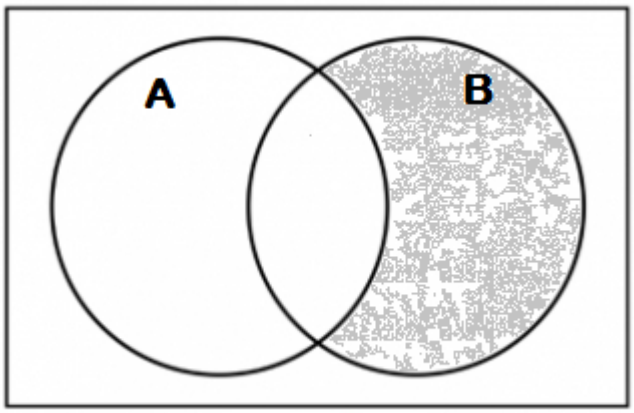
   (b) Is 2700 an element of M? Explain why or why not?

3. (6 points) Label the sets A and B, then shade the region corresponding to $A' \cap B'$.



4. (4 points) List all subsets of the set $\{a, b, c\}$.

5. (4 points) Use set notation to name the shaded region.



6. (8 points) Let $X = \{a, b, c, d, e, f\}$ and $Y = \{a, e, i, o, u\}$, and think of X and Y as subsets of the universal set $U = \{a, b, c, d, \ldots, x, y, z\}$ (that is, U is the set of the letters of the alphabet). Determine each of the following.

   (a) $X \cap Y$

   (b) $X - Y$

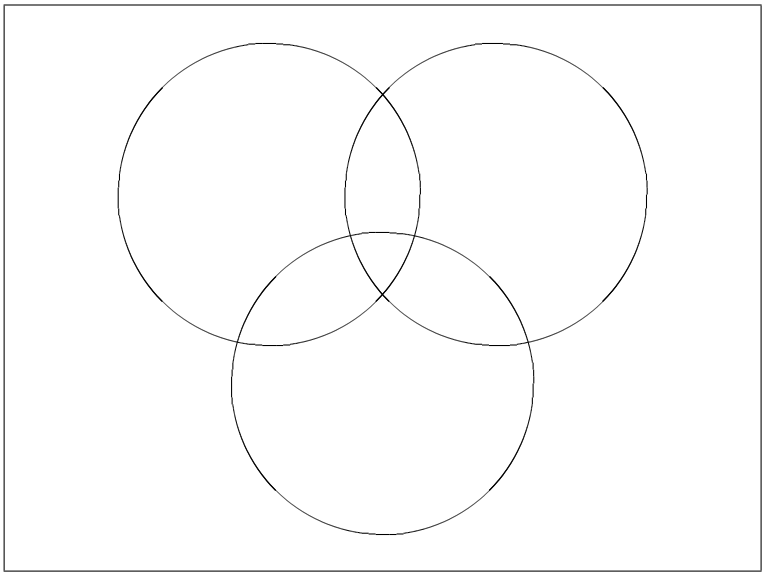
   (c) $X \cup \emptyset$

   (d) True or False: $r \in Y'$

7. (14 points) A criminal justice major is studying the frequency of certain types of crimes in a nearby county. He studies the arrest records of 300 inmates at a jail, specifically asking about drug-related offenses, domestic violence, and theft. He finds the following:

   - 194 had been arrested for theft,
   - 210 for drug offenses,
   - 170 for domestic violence,
   - 142 for both theft and drugs,
   - 111 for both drugs and domestic violence,
   - 91 for both theft and domestic violence, and
   - 45 had been arrested for all three offenses.

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



   (b) How many inmates had been arrested for drug-related offenses only?

   (c) How many inmates had been arrested for two, but not three, offenses?

   (d) How many inmates had been arrested for none of these offenses?

8. (4 points) Identify each as a conjunction, disjunction, conditional, or biconditional.

   (a) When your battery dies, you need to charge your phone.

   (b) Her nails are long, and they have rhinestones on them.

9. (4 points) Write the negation of each statement.

   (a) Some people are very busy.

   (b) No men can join a sorority.

10. (6 points) Let p = "Mark lives on campus" and let q = "Trudy lives off campus." Write each statement in words.

    (a) $q \longrightarrow p$

    (b) $\sim p \wedge \sim p$

11. (4 points) Refer to the statements p and q from the problem directly above. Write each statement in symbolic form.

    (a) Mark lives on campus if and only if Trudy lives off campus.

    (b) Mark does not live on campus if Trudy lives off campus.

12. (8 points) Construct the truth table for $(p \vee q) \longrightarrow \sim p$.

13. (8 points) Consider the following conditional statement:

If he gets caught, then he will go to jail.

(a) State the inverse.

(b) State the contrapositive.

(c) State the converse.

(d) Of the following three choices, which one is logically equivalent to the inverse of the original statement?

Inverse Contrapositive Converse

14. (4 points) Shaveece invests \$1250 at 8.35% simple interest for five and a half years. How much does she have at the end of the investment period?

15. (10 points) Marcus sets aside $8,000 in a savings account in which interest is compounded monthly at 3.85%.

    (a) How much money is in the account after 18 years?

    (b) How much money was made in interest?

16. (8 points) Mike and Jenny purchased new dining room furniture by agreeing to make monthly payments of $39.30 for six years. Their financing arrangement called for an interest rate of 13.99% compounded monthly. How much would the furniture cost if Mike and Jenny paid all at once in cash?

17. (16 points) A house sells for $212,000. You make a 8% down payment and, for the remaining amount, you obtain a 30-year fixed rate mortgage at 4.25% compounded monthly.

(a) What is the loan amount?

(b) What are the monthly payments?

(c) At the end of the 30-year loan, how much will you have paid?

(d) Construct the 1st line of the amortization schedule for the loan.

18. (8 points) A fair six-sided die is rolled.

(a) What is the sample space?

(b) What is the event of rolling an odd number? Write the event in roster notation.

(c) What is the probability of rolling a 4?

(d) What is the probability of rolling a even number?

19. (6 points) In studying the effectiveness of a test preparation course, the following data were collected.

	Passed Test	Failed Test
Took Test-Prep Class	137	43
Did not take Test-Prep Class	213	105

A person from this sample is selected at random.

(a) What is the probability that the person passed the test?

(b) What is the probability that the person took the test preparation class and passed the test?

(c) What is the probability that the person passed the test or took the test preparation class?

20. (3 points) The probability of the event A is 5/13. What is the probability of A'?

21. (3 points) Jon is about to roll a four-sided die. He claims that each side of the die has a probability of 25. Is he correct? Explain.

22. (12 points) A jar contains 8 quarters and 5 dimes. Two coins are selected at random, without replacement.

    (a) Sketch the complete tree diagram for this experiment. **Include the probabilities of each path.**

    (b) What is the probability of selecting 35 cents?

    (c) What is the probability of selecting more than 35 cents?