1. Let **U** = {a, b, c, d, e, f, g, h, i, j } and let
R = {a, c, e, g, i } ; **S** = {b, c, d, e, f } ; **T** = {a, b, f, g, h}

Which of the sets below is **(R' ∪ S) ∩ T** ?

(a) {c, e, f} (b) {b, d, f } (c) {a, b, d, f, g, h } (d) ∅

(e) {b, f, h }

2. Consider the following sets:

U = {all cats}

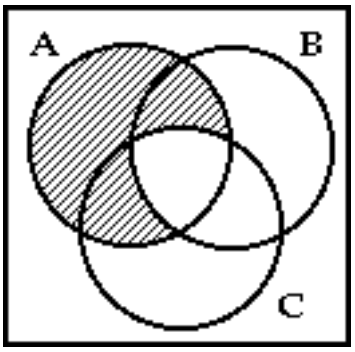
A = {all female cats}

B = {all cats at most 5 years old}

Then the set **(A ∪ B′)'** is the set of

(a) {cats who are either male or at most 5 years old}
(b) {male cats who are at most 5 years old}
(c) {male cats who are over 5 years old}
(d) {female cats who are at most 5 years old}
(e) {cats who are either female or under 5 years old}

3. Identify the shaded region in the following Venn diagram:



(a) $(\mathbf{A \cap B') \cap C}$ (b) $\mathbf{(A \cup B) \cup C}$ (c) $\mathbf{A \cap (B \cap C)'}$

(d) $\mathbf{(B \cup C) \cap A'}$ (e) $\mathbf{(A \cup C') \cap B'}$

4. A survey of 100 business travelers revealed that 58 of them had made some trips by bus, 63 of them by airplane, 20 of them by train and by bus, 14 of them by airplane and train, 29 of them only by airplane, 10 of them had used all three modes of transportation. Every traveler had made at least one trip. The number of customers who had used the train in some of their trips is

(a) 33 (b) 9 (c) 37 (d) 50 (e) none of these

5. If **R** and **S** are finite subsets of a universal set **U**, such that

$$\mathbf{n(R) = 20,\ n(S') = 15,\ n(S \cup R) = 35 \text{ and } n(U) = 40}$$

how many elements are there in $\mathbf{S \cap R}$?

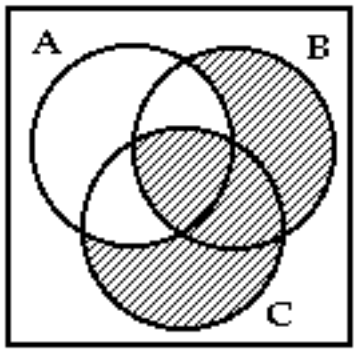
(a) 0 (b) 15 (c) 25 (d) 20 (e) 10

6. This exam has 20 multiple-choice questions, each having 5 possible answers. In how many different ways can the exam be answered? (Assume that every question must be answered.)

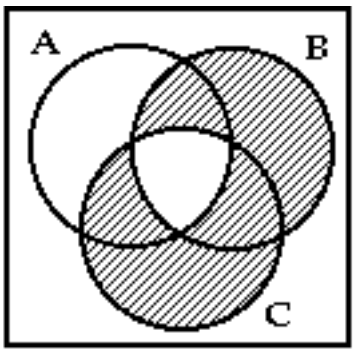
(a) 20x5! (b) $\binom{20}{5}$ (c) 100 (d) 5^{20} (e) 20^5

7In which Venn diagram does the shaded portion represent $(B \cup C) \cap A'$?

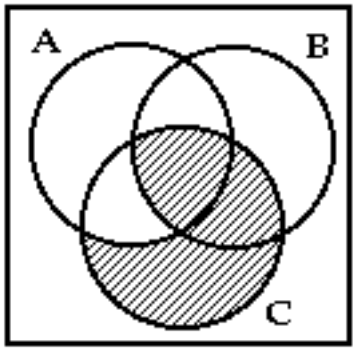
(a)



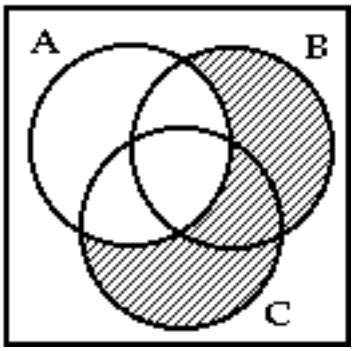
(b)



(c)



(d)



(e) none of the above

8. A set **X** has exactly 6 elements. How many distinct subsets of **X** have at least three elements?

(a) 42 (b) 2^6 (c) P(6,2) (d) C(6,2)

(e) 36

9. How many 3-digit numbers greater than 500 can be formed using the digits

{ 1, 2, 3, 4, 5, 6, 7, 8 }

if no repetitions are allowed?

(a) P(9,3) (b) 168 (c) C(8,3) (d) P(8,3) (e) 8 !

10. A list of food preferences of 55 species of cats is included when you buy a bag of SnootyTooty cat food. The list states that 30 species like seafood products, 30 like meat products, 18 like dairy products. 15 like both seafood and meat products, 10 like both seafood and dairy products, while 8 like both meat and dairy products. Further, 5 species like all three of the above types of food. How many species like only one of the above types of food?

(a) 27 (b) 28 (c) 29 (d) 30

(e) none of these

11. What is the coefficient of x^3y^6 in the expansion of $(x + y)^9$?

(a) 56 (b) 84 (c) 90 (d) 210 (e) 18

12. A bag contains 8 blue marbles and 10 red marbles. In how many ways can five marbles be chosen from the bag, without replacement, so that 3 of the chosen marbles are blue and 2 are red?

(a) $\binom{3}{2}$ (b) $\binom{18}{5}$ (c) $\binom{8}{3} \cdot \binom{10}{2}$

(d) $\binom{8}{2} \cdot \binom{10}{3}$ (e) $P(8,3) \cdot P(10,2)$

13. Which of the following is a valid probability distribution for the sample space **S** = {x, y, z } ?

(a) Pr(x) = 0.7 Pr(y) = 0.1 Pr(z) = 0.1

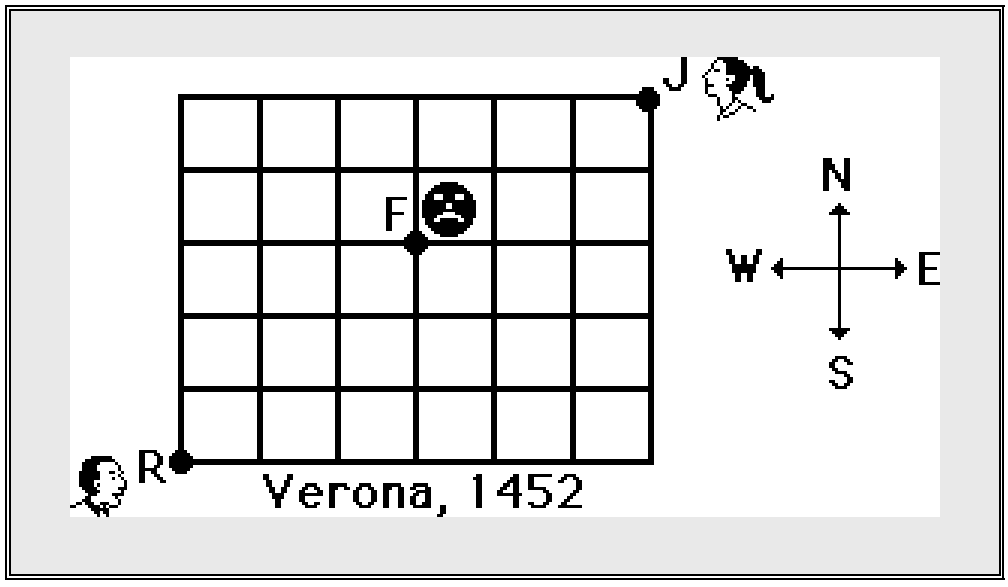
(b) Pr(x) = -0.2 Pr(y) = 0.4 Pr(z) = 0.8

(c) Pr(x) = 0.8 Pr(y) = 0.4 Pr(z) = 0.2

(d) Pr(x) = 0.6 Pr(y) = 0.2 Pr(z) = 0.2

(e) none of the above

14. Here is a street map of Verona in 1452. Romeo is at **R**, Juliet is with her aunt at **J**. The house of Juliet's father is at **F**. In how many ways can Romeo reach Juliet, making sure first that her father is asleep in his house, if Romeo travels North and East only?



(a) $\binom{11}{5} - \binom{6}{3} \cdot \binom{5}{2}$ (b) $\binom{11}{5}$ (c) $\binom{6}{3} \cdot \binom{5}{2}$

(d) $\binom{11}{6}$ (e) 5^6

15. How many subsets of the set {1, 2, 3, 4, 5, 6, 7 } contain no even digits?

(a) $\binom{7}{4}$ (b) P(7,3) (c) $\frac{7!}{4!}$ (d) 2^7 (e) 16

16. A red die and a green die are tossed and the numbers on the uppermost sides are observed. What is the probability that the numbers add up to 5 ?

(a) $\frac{4}{36}$ (b) $\frac{8}{36}$ (c) $\frac{7}{36}$ (d) $\frac{9}{36}$ (e) $\frac{6}{36}$

17. You have been given 11 football helmets to paint. Six must be gold, three silver, and two white. In how many different ways can the helmets be painted?

(a) 840 (b) 4,620 (c) 5,040 (d) 11! (e) 1

18. An experiment consists of observing the size and brand of running shoes in the JACC Faculty locker room. Let

E be the event "the size is 11"
F be the event "the brand is a Nike"
G be the event "the size is 10 or the brand is Nike"
H be the event "the brand is New Balance or Adida"

Which of the following pair of events are mutually exclusive?

(a) E and F (b) E and G (c) E and H
(d) F and H (e) F and G

19. A digit is selected at random from the digits {1, 2, 3, 4, 5, 6, 7, 8, 9 } . What is the probability that the digit is odd and less than 6?

(a) $\frac{2}{3}$ (b) $\frac{4}{9}$ (c) $\frac{1}{3}$ (d) $\frac{5}{9}$ (e) $\frac{4}{3}$

20. The odds in favor of a consonant in my instructor's last name are:

(a) 3 to 3 (b) 4 to 3 (c) 5 to 3 (d) 6 to 3 (e) 3 to 2