1. If

$$x = a \qquad y = b \qquad z = c$$

is the solution of the linear system shown below:

$$\begin{cases} x & - & y & + & z & = & 2 \\ x & - & 2y & + & 2z & = & 3 \\ 2x & + & y & - & 2z & = & 2 \end{cases}$$

then $a + b + c$ equals
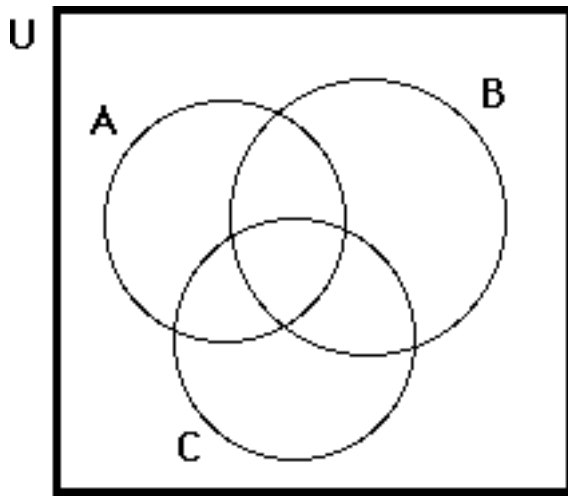
(a) 2   (b) 1   (c) 0   (d) –1   (e) –2

2. Let A be the matrix $\begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix}$. Then A^3 equals the matrix

(a) $\begin{pmatrix} 1 & 0 \\ -3 & 1 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$ (c) $\begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix}$

(d) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ (e) none of the above

3. Let $U = \{a, b, c, d, e, f, g, h, i, j\}$ be the universe and let

$A = \{a, c, e, g, i\}$; $\qquad$ $B = \{a, b, c, d, e\}$; $C = \{c, d, e, f, g, h, i, j\}$

Then the set $\qquad$ $(A \cap B) \cup C'$ $\quad$ is

(a) $\{a\}$ $\qquad\qquad$ (b) $\{a, b\}$ $\qquad\qquad$ (c) **U** $\qquad\qquad\qquad$ (d) $\{a, b, c, e\}$

(e) $\varnothing$

4. Given:

$n(U) = 50$

$n(A \cap B \cap C) = 5$

$n(A \cap B) = 8$

$n(A \cap C) = 9$

$n(B \cap C) = 10$

$n(A) = 28$

$n(B) = 20$

$n(C) = 19$

$n(A \cup B \cup C) = p$

$n[(A \cap B \cap C)'] = q$

then

(a) $p = 45$ and $q = 5$ $\qquad$ (b) $p = 45$ and $q = 45$ $\qquad$ (c) $p = 5$ and $q = 45$

(d) $p = 5$ and $q = 5$ $\qquad\qquad$ (e) none of these

5. You are flying to San Francisco for the Holidays, departing from South Bend. You can choose to go via Chicago or via Pittsburgh. There are four flights from South Bend arriving in Chicago before noon, and there are three afternoon flights you can take from Chicago to San Francisco. There are two flights from South Bend arriving in Pittsburgh before noon, and there are four afternoon flights you can take from Pittsburgh to San Francisco. How many different schedules are available for your trip?

    (a) 8   (b) 12   (c) 20   (d) 96   (e) none of these

6. I am on an exercise regime which requires me to jog half an hour three days a week, swim twenty laps three days a week and bike eight miles one day a week. I can't do two exercises in one day, since I may keel over from exhaustion. Other than that, I may choose which exercise to do on which day of the week as I please. How many different exercise schedules can I make up for one week?

    (a) 5,040 (b) 105   (c) 48   (d) 140   (e) 13,612,578

7. How many possible ways are there of lining up 7 children for a photograph if the only two girls in the group (Sarah and Nancy) are required to stand at the two outside ends?

    (a) $7! - 2 \times 5!$ (b) $\dfrac{7!}{2}$ (c) $2 \times 5!$ (d) $C(7,5)$ (e) $P(7,6)$

8. You will deposit $ 100.00 a month for three years in a Savings account which pays 6% APR compounded monthly. At the end of the three years the amount of dollars you will have in the Savings account is:

(a) $20,000.00 \geq (1.005^{12} - 1)$ (b) $20,000.00 \geq (1.005^{36} - 1)$ (c) $3,600.00$

(d) $20,000.00 \geq (1.005^{3} - 1)$ (e) $100.00 \geq (1.06^{12} - 1)$

9. What is the coefficient of $a^{10}b^{3}$ in the binomial expansion of $(a + b)^{13}$?

(a) 286   (b) 390   (c) 30   (d) 13   (e) 21

10. At Calientita Pizzeria the basic pizza is made with dough, cheese and tomato sauce. You can also order any combination of the five extra toppings listed below:

sausage   pepperoni   mushrooms onions   green peppers

How many different pizzas, including the basic one, can you order?

(a) 6   (b) 12   (c) 18   (d) 28   (e) 32

11. Two fair dice are rolled, and the numbers on their top faces are recorded.
Consider the following events:

> E : both numbers are even
>
> F : the sum of the two numbers is even
>
> G : at least one of the two numbers is a 5

Which of the following statements about these events is true?

- (a) E and F are mutually exclusive
- (b) E and G are mutually exclusive
- (c) F and G are mutually exclusive
- (d) each pair of these events is mutually exclusive
- (e) no two of these events are mutually exclusive

12. Suppose E and F are events with $P(E) = 0.3$, $P(F) = 0.4$ and $P(E \cup F) = 0.58$.
Which of the following statements is true?

- (a) E and F are mutually exclusive
- (b) E and F are NOT independent
- (c) E and F are independent
- (d) $E \cup F$ is the entire sample space
- (e) none of the above

13. Suppose that E and F are independent events with $Pr(E) = 0.6$ and $Pr(F) = 0.3$.
What is $Pr(E \cup F)$?

(a) 0.82   (b) 0.7   (c) 0.58   (d) 0.68   (e) 0.72

14. You roll two fair dice. What is the probability that you rolled two fives given that the sum you rolled was ten?

(a) $\frac{1}{3}$ (b) $\frac{3}{36}$ (c) $\frac{3}{5}$ (d) $\frac{1}{6}$ (e) 0

15. Given that $P(A) = 0.4$, $P(B) = 0.6$ and $P(A \cup B) = 0.7$, then $P(A \mid B)$ equals

(a) $\frac{1}{5}$ (b) $\frac{47}{1264}$ (c) $\frac{1}{3}$ (d) $\frac{1}{2}$ (e) $\frac{2}{21}$

16. In a certain game, you first toss a fair coin. If it comes up Heads you then toss a fair red die, otherwise you toss a fair green die. What is the probability that your die toss results in a red six, or a green five, or a green four ?

(a) $\frac{3}{36}$ (b) 0.60 (c) 0.30 (d) $\frac{1}{2}$ (e) $\frac{1}{4}$

THE NEXT TWO QUESTIONS (17 and 18) REFER TO THE FOLLOWING SITUATION:

The table below gives the distribution of voter registration and voter turnout for a certain city.

	Proportion registered	Proportion turnout
Democrat	0.50	0.40
Republican	0.20	0.50
Independent	0.30	0.70

17. What percentage of the registered voters actually turned out to vote?

    (a) 0.51   (b) 0.70   (c) 0.21   (d) $\frac{17}{7}$ (e) $\frac{7}{17}$

18. A randomly chosen person is questioned at the polls. What is the probability that the person is an Independent?

    (a) 0.51   (b) 0.70   (c) 0.21   (d) $\frac{17}{7}$ (e) $\frac{7}{17}$

THE NEXT TWO QUESTIONS (19 and 20) REFER TO THE FOLLOWING SITUATION:

A recent survey of the soft drink consuming habits of college students shows that 20% of them will switch from sodas to coffee over a one month period, while only 10% will switch from coffee to sodas over the same time period.

19. At the beginning of the 1999 Academic year 60% of the First Year students at Podunk University drink sodas. What percent of them will drink coffee one month later?
    (a) 52%   (b) 48%   (c) 46%   (d) 44%   (e) 42%

20. What portion of the 2003 graduating class will drink coffee at graduation?
    (a) 75%   (b) 50%   (c) $\frac{2}{3}$ (d) 25%   (e) $\frac{1}{3}$

THE NEXT TWO QUESTIONS (21 and 22) REFER TO THE FOLLOWING SITUATION:

Let **A** and **B** be the matrices shown below:

$$\mathbf{A} = \begin{pmatrix} 2 & 1 & 0 \\ 3 & 2 & 1 \end{pmatrix} \qquad \mathbf{B} = \begin{pmatrix} 1 & 1 & 2 & 0 \\ 2 & 1 & 1 & 2 \\ -1 & 1 & 2 & 0 \end{pmatrix}$$

21. The entry in the second row, third column of **A**≥**B** is

    (a) 4   (b) 6   (c) 8   (d) 10
    (e) these matrices cannot be multiplied in the order shown

22. The entry in the second row, third column of **B**≥**A** is

    (a) 4   (b) 6   (c) 8   (d) 10
    (e) these matrices cannot be multiplied in the order shown

THE NEXT TWO QUESTIONS (23 and 24) REFER TO THE FOLLOWING SITUATION:

The probability distribution for a random variable X is given below.

k	Pr(X=k)
−2	0.1
−1	0.1
0	0.4
1	0.2
2	0.2

23. What is the mean of X?
    (a) 0.1   (b) 0.2   (c) 0.3   (d) 0.4   (e) 0.5

24. What is the variance of X?
    (a) 1.5   (b) 1.41   (c) 0.3   (d) 0.15   (e) 14.10

25. Jody is enrolling at Podunk University as a first year student. Her grandmother wants to buy her a $ 5,000.00 computer system when she *(Jody, not grandma!)* graduates in four years. How high a CD should granny purchase which pays 8% APR compounded quarterly and which matures in four years? (A CD is a Certificate of Deposit which remains untouched, other than for interest accrued, until it matures.)

(a) 4,000.00

(b) $4,500 \geq (1.02)^{48}$

(c) $\dfrac{5,000.00}{1.02^{16}}$

(d) $\dfrac{5,000.00}{1.02^{48}}$

(e) Grandma cannot do it.

26. A random variable X (not necessarily normal) has mean 8 and standard deviation 1. Estimate $P(5 \leq X \leq 11)$.

(a) $\geq \dfrac{8}{9}$

(b) $\geq \dfrac{15}{16}$

(c) $\leq \dfrac{1}{2}$

(d) $\leq \dfrac{1}{9}$

(e) none of the above

27. Buonladro Bakery asserts that the weight of a loaf of bread sold at the bakery is normally distributed with $\mu = 750$ grams and $\sigma = 10$ grams. You bought a loaf of bread at the bakery. What is the probability that the loaf you bought weighs less than 735 grams?

    (a) 0.1587   (b) 20%   (c) 0.8413   (d) 0.0668   (e) 0.9332

28. Fesso lottery tickets on the island state of Taxem cost $1.00 each. Winning tickets pay $10.00 *(you actually win only nine dollars.)* The government advertises that, on the average, there is one winning ticket among every ten tickets sold. You buy 100 Fesso lottery tickets. Estimate the probability that at least twelve of your tickets are winners.

    (a) 0.3085   (b) 0.2119   (c) 0.0668   (d) 0.6680   (e) $\dfrac{3}{25}$