

Test 3 Review

Annuity

For questions 1 –6, state the type of problem and calculate the answer.

1. Parents of a college student wish to set up an account that will pay \$350 per month to the student for four years. How much should they deposit now at 9% annual interest, compounded monthly?

P.V.A.

$$E \left[\frac{1 - (1+i)^{-n}}{i} \right] = E(1 - (1+i)^{-n}) / (i)$$

↳ P.V.

$$P = \$14,064.67$$

2. What is the effective rate of interest for money invested at 10% annual interest compounded monthly?

Not on test

Annuity

3. Your friend's payments on his new car are \$524.37 per month. He received a \$3000 trade-in on his old car, and received a financing package that was 8.9% annual interest, compounded monthly for five years. What was the total purchase price of the car?

P.V.A.

$$= 524.37 \left(1 - (1 + 0.089/12)^{-60} \right) / (0.089/12)$$

↳ P.V.

$$= \text{Ans} + 3000 = \text{Final Answer}$$

$$25,319.83 + 3000 = \$28,319.83$$

4. A company estimates that it will have to replace a piece of equipment at a cost of \$10,000 in 5 years. The owner wants to have this money available when the equipment is replaced. He can make fixed quarterly payments and earn interest at 6% annual interest compounded quarterly. How much should the payments be?

↳ E??

~~Amortization~~ or Sinking Fund

$$E = \frac{F i}{(1+i)^n - 1}$$

$$\$ 432.46$$

Annuity

5. Jenna wants to begin saving money for a new car. She can make monthly payments of \$150 into an account at her credit union which pays 5% annual interest compounded monthly. How much money will she have available for her new car in three years?

R.F.V.

F.V.A.

$$F = E \left[\frac{(1+i)^n - 1}{i} \right] \quad \$ 5813$$

$$i = \frac{r}{m}$$

$$n = mt$$

6. The manager of a manufacturing company knows that they will need a new machine in one of their factories. The new machine will cost them \$12,500. The manager has determined that they can afford to pay 20% of the cost of the machine in cash. They can then finance the rest through a credit union. The credit union will charge 2% per year compounded monthly. How much are their monthly payments for 4 years?

↳ E??

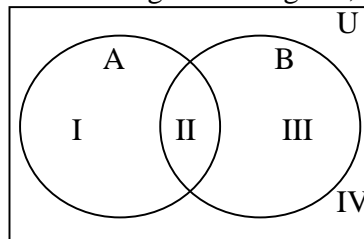
~~Amortization or Sinking Fund~~

$$E = \frac{P i}{1 - (1+i)^{-n}}$$

$$P = 12,500 - 12,500(0.2) = 12,500(0.8)$$

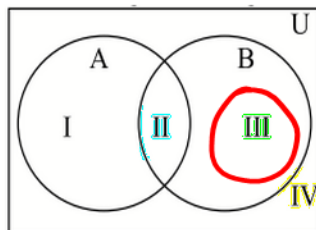
$$E = \$216.95$$

Example 7: Given the following Venn diagram, which region(s) make(s) up:



a. $A^c \cap B$

B only

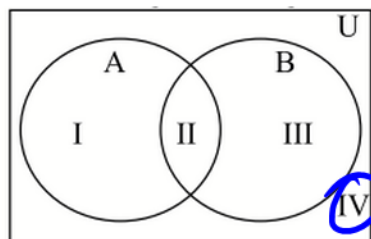


= III

b. $A^c \cap B^c$

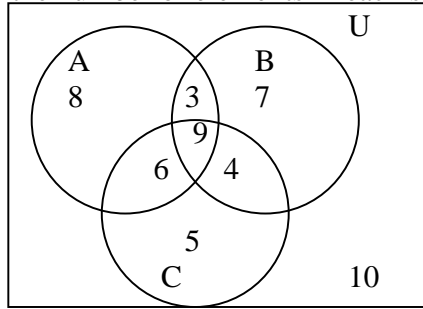
Apply DeMorgan's

$$(A \cup B)^c$$



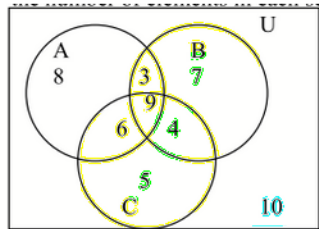
= Outside the circles = IV

Example 8: Find the number of elements in each set.



a. $n(B \cup C \cap A^c)$

In common

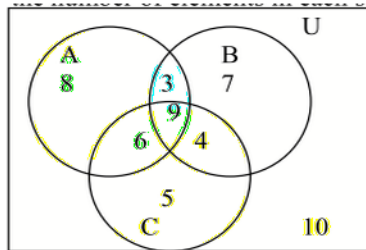


$$7 + 4 + 5 = 16$$

b. $n(A^c \cup (C^c \cap B)^c)$

$$= n(A \cap (C^c \cap B)^c)$$

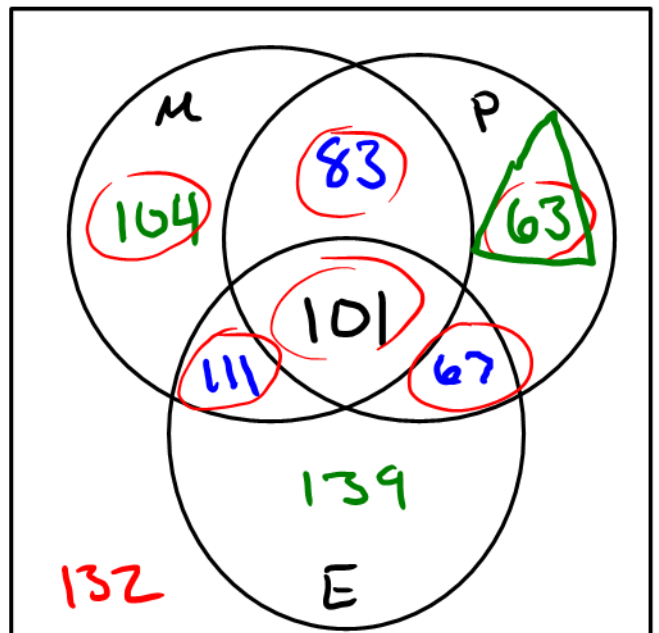
$$= n(A \cap (C \cup B)^c)$$



$$6 + 9 + 9 = 23 \quad A \cap (C \cup B)^c$$

Example 9: 800 college freshmen were surveyed regarding their enrollment in Math, Physics and English classes. The survey revealed the following:

- 184 were enrolled in Physics and Math
- 399 were enrolled in Math
- 168 were enrolled in Physics and English
- 314 were enrolled in Physics
- 101 were enrolled in all three
- 212 were enrolled in Math and English
- 418 were enrolled in English



a. How many were enrolled in Math or Physics?

$$M \cup P = 529$$

b. How many were not enrolled in Math or English but were enrolled in Physics?

$$(M \cup E)^c \cap P = 63$$

Example 10: Suppose 4 pens are selected at random from a box containing 9 yellow pens and 6 blue pens. In how many ways can you choose at least 1 yellow pen?

4 3 2 1 0	B	}	Complement		
			Y	B	
			0	4	
			$E^c = C(9,0) \times C(6,4)$		
			$= 15$		

$$E = \text{Universe} - E^c$$

$$= C(15,4) - 15$$

$$= 1365 - 15$$

$$= \boxed{1350}$$

Example 11: A club has 58 members, 38 men and 20 women. A committee must consist of 8 people. In how many ways can the committee consist of at most 1 woman?

3 0 1	M	
	8	$C(20,0) \cdot C(38,8) = 44,403,492$
	7	$C(20,1) \cdot C(38,7) = 252,405,120$

$$+$$

$$\boxed{301,308,612}$$

Example 12: A business organization needs to make up a 5 member fund-raising committee. The organization has 10 accounting majors and 8 finance majors. In how many ways can the fund-raising committee be formed if at most 1 accounting major is on the committee?

Acct	Finan.	
1	4	$C(10,1) \times C(4,4) = 700$
0	5	$C(10,0) \times C(4,5) = 56$

$$\boxed{756}$$

Example 13: If a coin is tossed 14 times.

$$n(S) = 2^{\text{tosses}} = 2^{14} = 16,384$$

a. What is the probability that heads will come up exactly 10 times?

$$E = C(\text{tosses}, \# \text{ of Heads}) \\ = C(14, 10) = 1001$$

$$P(E) = \frac{1001}{16,384} = 0.0611$$

b. What is the probability that heads comes up at most 12 times?

$$E = 0, 1, 2, \dots, 12, \text{ Heads}$$

$$P(E) = 1 - P(E^c)$$

$$E^c = 13, 14 = C(14, 13) + C(14, 14) = 15$$

$$= 1 - \frac{15}{16,384} \approx 0.9991$$

Example 14: A box contains 20 computer chips, 5 of which are defective. Seven chips are taken out at random for testing. What is the probability that

$$n(S) = C(20, 7) = 77,520$$

a. at least 4 are defective?

Def	Good
4	3
5	2
6	1
7	0

$$C(5, 4) \times C(15, 3) = 2275 \\ C(5, 5) \times C(15, 2) = 105 \\ \hline 2380$$

$$P(E) = \frac{2380}{77,520}$$

$$= 0.03070$$

Not Actual Situations

b. at most 4 are defective?

Def	Good
4	3
3	4
2	5
1	6
0	7

Complement

Def	Good
5	2

Too Much work

$$E^c = C(5, 5) \cdot C(15, 2) = 105$$

$$P(E) = 1 - P(E^c)$$

$$1 - \frac{105}{77,520} = 0.9986$$

Popper 19

1. A. Yes B. No

20 tosses Looking for at most 17 tails

Should I use the complement to shorten the process?

2. B

3. 8 member committee

14 Jr, 26 Sr At least 2 Sr partners
40

Sr	Jr	}	Comp		$n(E) = n(U) - n(E^c)$ $= C(40,8) - (x+y)$
2	6		Sr Jr		
3	5		1 7		
4	4		0 8		
5	3				
6	2				
7	1				

$(26,1) C(14,7) = x$
 $C(26,0) \cdot C(14,8) = y$ } Add

3. D

PRINTABLE VERSION

Practice Test 3

Question 1

A problem is listed below. Identify its type.

Annuity

Mr. Garcia is planning for retirement. He deposits \$700 each month into a retirement account. The account pays 6% per year compounded monthly. How much will he have in 22 years when he retires?

↳ Future Value

- a) Present Value of an Annuity
- b) Amortization
- c) Future Value of an Annuity
- d) Present Value
- e) Sinking Fund
- f) None of the above.

Question 2

Congratulations! You were the 10th caller on the KMTH morning show and you just won \$7,000.00. After you calm down, you decide to put the money into a bank account so that you will have even more money for a trip to Europe. Snurling Bank tells you that they will pay 4% per year compounded monthly. How much money will you have for your trip in 7 years?

F.V.

- a) \$9,256.60
- b) \$9,261.60
- c) \$9,257.60
- d) \$9,254.60
- e) \$9,259.60
- f) None of the above.

One time Deposit = 7000

$$F = P(1+i)^n$$

$$= 7000(1 + 0.04/12)^{84}$$

$$= \$9,257.60$$

Question 3

Jennifer bought a brand new treadmill on a credit plan at BeFit Exercise Equipment. BeFit will

Annuity

charge her 18% per year compounded monthly. If her monthly payments will be \$150 for 2 years, how much was the original price of the treadmill?

- a) \$3,001.56
- b) \$3,007.56
- c) \$3,004.56
- d) \$3,003.56
- e) \$3,006.56
- f) None of the above.

↳ PV.

$$P = E \left[\frac{1 - (1+i)^{-n}}{i} \right]$$

$$= 150 \left[\frac{1 - (1 + 0.18/12)^{-24}}{(0.18/12)} \right]$$

Question 4

A problem is listed below. Identify its type.

After graduation in 3 years, Antwone would like to take a much needed vacation to the Caribbean Islands. He anticipates that the all inclusive vacation package will cost him \$4,000. His bank will pay 7% per year compounded semiannually. How much does he need to deposit into this account each semiannual period, so that he can take his vacation in 3 years?

- a) Present Value of an Annuity
- b) Amortization
- c) Sinking Fund
- d) Future Value with compound interest
- e) Present Value with compound interest
- f) None of the above.

↳ E??

"Saving Money"

= Sinking Fund

Question 5

Annuity

Esther pays \$355 per month for 6 years for a car. She made a down payment of \$2,500. If the loan costs 7.1% per year compounded monthly, what was the cash price of the car?

- a) \$18,263.80
- b) \$34,252.00
- c) \$23,263.80

P.V.

$$P = E \left(\frac{1 - (1+i)^{-n}}{i} \right)$$

$$= 355 \left(\frac{1 - (1 + 0.071/12)^{-72}}{(0.071/12)} \right)$$

$$\begin{array}{r}
 = 20,763.80 \\
 + 2,500.00 \\
 \hline
 23,263.80
 \end{array}$$

- d) \$20,763.80
- e) \$29,252.00
- f) None of the above.

Question 6

Given the following sets

$$U = \{2, 4, 7, 9, 13, 19, 29, 33, 37, 44\}$$

$$A = \{7, 15, 19, 33, 37, 44\}$$

$$B = \{2, 9, 29, 33\}$$

$$C = \{4, 7, 9, 33\}$$

In Common

(B ∩ C)

Determine the set $A^c \cup (B \cap C)$.

A^c

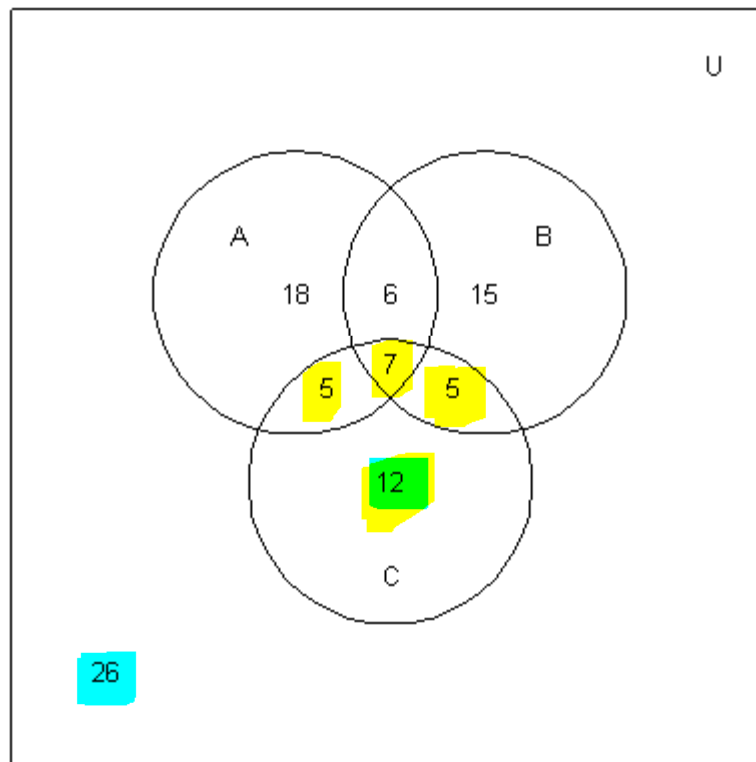
$$\{2, 4, 9, 29\} \cup \{9, 33\}$$

$$\{2, 4, 9, 29, 33\}$$

- a) \emptyset
- b) {2,4,7,29,33}
- c) {2,4,9,19,33}
- d) {2,7,9,29,33}
- e) {2,4,9,29,33}
- f) None of the above.

Question 7

Given the following Venn diagram



Find $n[(A \cup B)^c \cap C]$.

a) 12

b) 16

c) 21

d) 14

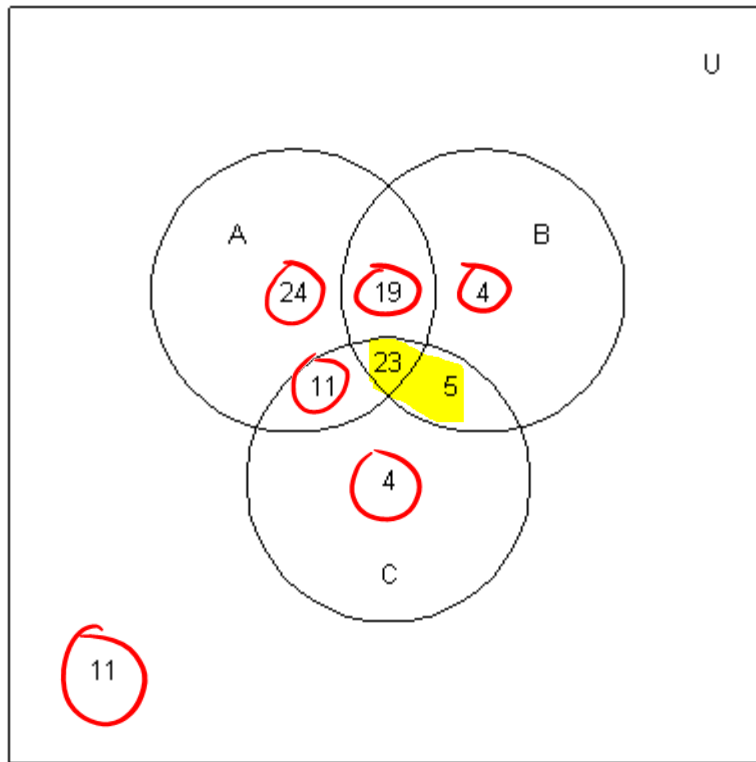
e) 19

f) None of the above.

In Common

Question 8

Given the following Venn diagram



Find $n[(B \cap C)^c]$.

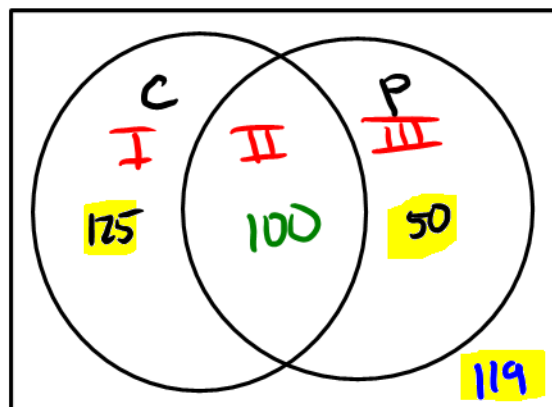
$$24 + 19 + 4 + 11 + 4 + 11$$

- a) 5
- b) 28
- c) 42
- d) 73**
- e) 59
- f) None of the above.

Question 9

A survey of 394 children given at a local elementary school showed that 225 like chocolate ice cream, 150 like pistachio ice cream, and 119 do not like chocolate or pistachio ice cream. How many children like at most one kind of ice cream mentioned in the survey?

- a) 375
- b) 294**
- c) 125



$$\begin{aligned}
 n(C \cup P)^c &= 119 \\
 n(C \cup P) &= U - 119 \\
 &= 394 - 119 \\
 &= 275
 \end{aligned}$$

$$* n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

$$n(C \cup P) = n(C) + n(P) - n(C \cap P)$$

$$275 = 225 + 150 - n(C \cap P)$$

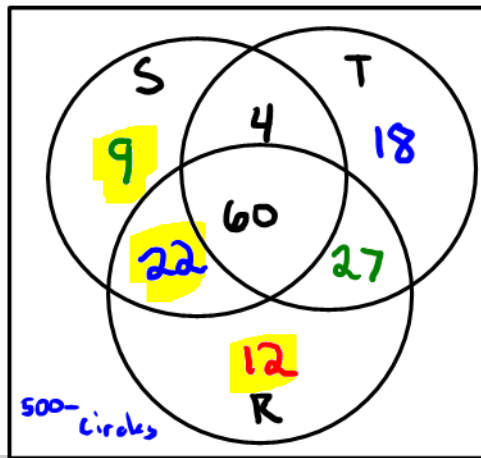
$$100 = n(C \cap P)$$

- d) 50
- e) 244
- f) None of the above.

Question 10

A survey of 500 high school students was taken to determine their favorite chocolate candy. Of the 500 students surveyed, 95 like Snickers, 109 like Twix, 121 like Reese's Peanut Butter Cups, 64 like Snickers and Twix, 87 like Twix and Reese's Peanut Butter Cups, 82 like Snickers and Reese's Peanut Butter Cups, and 60 like all three kinds of chocolate candy. How many students like Reese's Peanut Butter Cups or Snickers, but not Twix?

- a) 31
- b) 74
- c) 103
- d) 21
- e) 43
- f) None of the above.



Question 11

A license plate consists of 2 letters followed by 1 digit. How many license plates are possible if the 1st letter cannot be I nor O, the digit cannot be 0, and no letters or digits may repeat?

- a) 6,760
- b) 6,000
- c) 5,400
- d) 5,616
- e) 4,800
- f) None of the above.

$$\frac{24}{\text{Not "I or O"}} \times \frac{25}{\text{1-9}} \times \frac{9}{\text{1-9}}$$

Question 12

How many permutations can be formed from all the letters in the word ENGINEERING?

11 letters

$$\frac{n!}{n_1! \cdot n_2! \cdot \dots}$$

- a) 39,916,800
- b) 435,600
- c) 277,200
- d) 144
- e) 108,900
- f) None of the above.

E - 3
N - 3
G - 2
I - 2
R - 1

$$\frac{11!}{3! \cdot 3! \cdot 2! \cdot 2! \cdot 1!}$$

Question 13

After a bride has interviewed 8 DJs to play at her wedding, her fiance tells her she needs to narrow it down to 3 DJs. In how many ways can she rank the 3 DJs?

- a) 336
- b) 56
- c) 24
- d) 40,320
- e) 3
- f) None of the above.

↳ Order Matters = Perm.

$$P(8, 3)$$

Question 14

In how many ways can 4 cards be drawn from a well-shuffled deck of 52 playing cards?

- a) 6,497,400
- b) 3
- c) 24
- d) 270,725
- e) 16
- f) None of the above.

Order Does Not Matter

$$C(52, 4) = 270,725$$

Question 15

A fast-food restaurant offers 6 different burgers, 6 different side orders, 8 different flavor drinks, and 9 different flavors of ice cream. In how many ways can a combo containing 2 burgers, 3 different sides, 3 different flavor drinks, and 3 ice cream flavors be made?

- a) 175
 b) 1,411,200
 c) 404,640
 d) 54
 e) 2,592
 f) None of the above.

$$\begin{array}{cccc}
 \text{Burgers} & \text{Sides} & \text{Drinks} & \text{Ice Cream} \\
 C(6,2) & \times C(6,3) & \times C(8,3) & \times C(9,3) \\
 & & & 1,411,200
 \end{array}$$

Question 16

An urn contains 17 red marbles and 17 blue marbles. 16 marbles are chosen. In how many ways can 5 red marbles be chosen?

- a) 6,188
 b) 76,582,688
 c) 18,564
 d) 85
 e) 4,368
 f) None of the above.

$$\begin{array}{cc}
 \text{Red} & \text{Blue} \\
 5 & 11 \quad \leftarrow \text{Remember 16 total chosen} \\
 C(17,5) \times C(17,11) = 76,582,688
 \end{array}$$

Question 17

A fair coin is tossed 27 times. In how many outcomes do at most 25 heads occur?

- a) 351
 b) 379
 c) 134,217,700
 d) 134,217,349
 e) 28

$$\begin{array}{l}
 E = 0-25 \text{ Heads} \quad E^c = 26, 27 \text{ Heads} \\
 \text{LESS WORK} \\
 n(E^c) = C(27,26) + C(27,27) \\
 = 27 + 1 = 28 \\
 n(E) = n(U) - n(E^c) \\
 = 2^{27} - 28 = 134,217,700
 \end{array}$$

f) None of the above.

Question 18

Given $P(A) = .36$, $P(B) = .40$ and $P(A \cap B^c) = .17$. Find $P(A \cap B)$.

↪ strictly A
↪ Middle

a) 0.93

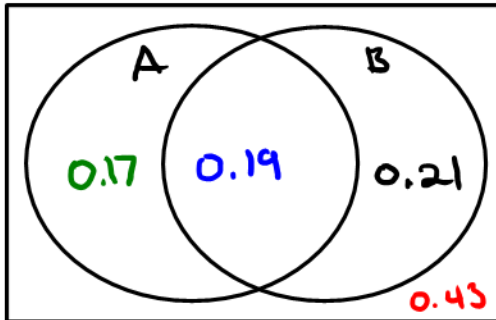
b) 0.13

c) 0.18

d) 0.19

e) 0.36

f) None of the above.



$$1 - (0.17 + 0.19 + 0.21)$$

$$1 - (0.57)$$

$$= 0.43$$

Question 19

Suppose $P(E) = 0.44$, $P(F^c) = 0.57$, and $P(F \cap E^c) = 0.23$. Find $P(E \cup F)$.

↪ strictly F

a) 0.01

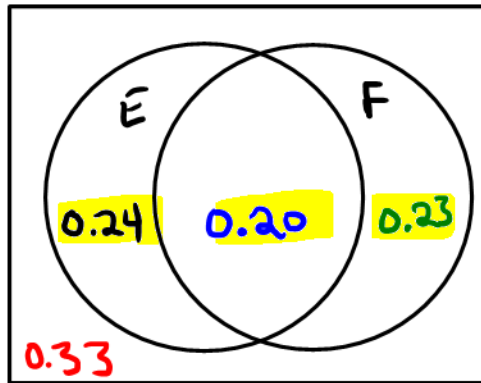
b) 0.67

c) 0.20

d) 0.33

e) 0.21

f) None of the above.



$$P(F) + P(F^c) = 1$$

$$P(F) = 1 - P(F^c)$$

$$= 1 - 0.57$$

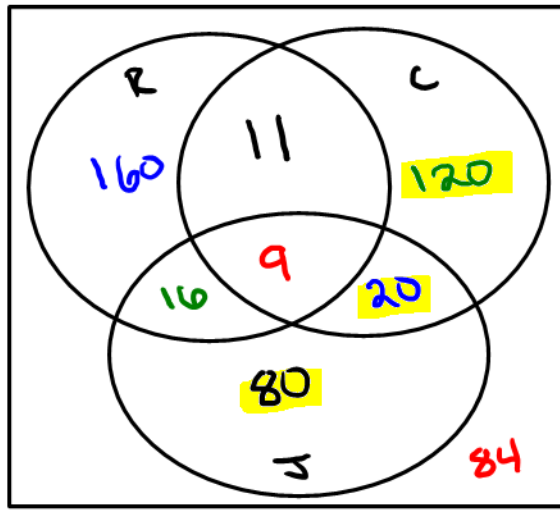
$$= 0.43$$

Question 20

A campus radio station surveyed 500 students to determine the types of music they like. The survey revealed that 196 like rock, 160 like country, and 125 like jazz. Moreover, 20 like rock and country, 25 like rock and jazz, 29 like country and jazz, and 9 like all three types of music. What is the probability that a randomly selected student likes jazz or country but not rock? Note: A Venn diagram may be useful here.

a) 0.280

- b) 0.258
- c) 0.400
- d) 0.520
- e) 0.440**
- f) None of the above.



3 Circle total = 416
 $500 - 416 = 84$
 $\frac{120 + 20 + 80}{500} = \frac{220}{500}$
 $= 0.44$

Question 21

A hand of 9 cards is dealt from a well-shuffled standard 52-card deck of cards. What is the probability that the hand contains 2 Jacks?

- a) 0.120078**
- b) 0.150078
- c) 0.160078
- d) 0.130078
- e) 0.140078
- f) None of the above.

Jacks (4) Not Jacks (48)
 2 7 ← Remember 9 total cards
 $C(4,2) \times C(48,7) = 441774432$
 $n(S) = C(52,9) = 3,679,075,400$
 $\frac{441774432}{3,679,075,400}$

Question 22

A classroom of children has 11 boys and 13 girls in which five students are chosen to do presentations. What is the probability that at least four boys are chosen?

- a) 0.403727
- b) 0.100932
- c) 0.302795
- d) 0.111801**
- e) 0.010870
- f) None of the above.

Boys (11) Girls (13)
 4 1
 5 0
 $\frac{C(11,4) \cdot C(13,1) + C(11,5) \cdot C(13,0)}{C(24,5)}$

Question 23

$$n(s) = 2^{24} = 16,777,216$$

A fair coin is tossed 24 times. What is the probability that at most 21 tails occur?

a) 0.00012064

b) 0.99998206

c) 0.99986142

d) 0.00001794

e) 0.01013858

f) None of the above.

$$E = 0 - 21 \text{ tails} \quad E^c = 22, 23, 24 \text{ tails}$$

$$n(E^c) = C(24, 22) + C(24, 23) + C(24, 24) \\ = 276 + 24 + 1 = 301$$

$$P(E) = 1 - P(E^c)$$

$$1 - \frac{301}{16,777,216} = 0.999982059$$

Question 24

$$n(s) = C(22, 7)$$

An urn contains 14 white balls and 8 green balls. A sample of seven is selected at random. What is the probability that the sample contains at least one green ball?

a) 0.999953

b) 0.000047

c) 0.140867

d) 0.859133

e) 0.979876

f) None of the above.

Green(8)	White(14)
1	6
2	5
3	4
4	3
5	2
6	1
7	0

Too Much Work

Complement
6 W
0 7

$$C(8, 0) \cdot C(14, 7) = 3432$$

$$P(E) = 1 - P(E^c)$$

$$= 1 - \frac{3432}{C(22, 7)} = 0.979876$$

Question 25

A classroom of children has 16 boys and 19 girls in which five students are chosen to do presentations. What is the probability that more boys than girls are chosen?

a) 0.4015

b) 0.0135

c) 0.4150

d) 0.3084

e) 0.1065

See Example 7 in 6.4

f) None of the above.

S. E

32 D

16 A

21 B

42 C

50 B