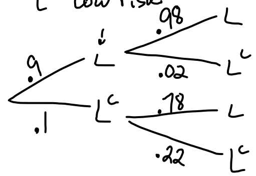
Math 166 - Final Exam Review

The following review covers Sections 2.1-2.6, 5.1-5.3, A.1, A.2, 6.1-6.4, 7.1-7.6, 8.1-8.6, 9.1, 9.2, 9.4, and 9.5 and contains about 1 problem (or 1 part of a problem) per section. Since many sections contain multiple topics that can be addressed in separate problems, this review should not be used as your sole source of practice problems as you study for the final exam. You should also review all examples demonstrated in lecture, problems on the exams and quizzes you have taken this semester, the suggested homework problems from your textbook, the problems from the online homeworks, and problems from previous week-in-reviews.

1. An insurance company classifies drivers as low-risk if they are accident-free for 1 year. Past records indicate that 98% of the drivers in the low-risk category one year will remain in that category the next year, and 78% of the drivers who are not in the low-risk category one year will move to the low-risk category the next year. (pg. 598 of *Finite Mathematics for Business, Economics, Life Sciences, and Social Sciences* by Barnett, Ziegler, and Byleen)

(a) If 90% of the drivers in the community are in the low-risk category this year, what is the probability that a driver chosen at random from the community will be in the low-risk category two years from now?

L - Low risk



$T = \begin{bmatrix} .98 & .78 \\ .02 & .22 \end{bmatrix}$

$X_0 = \begin{bmatrix} .9 \\ .1 \end{bmatrix}$

$$X_2 = T^2 X_0 = \begin{bmatrix} .972 \\ .028 \end{bmatrix}$$

$\boxed{.972}$ = prob a person is in low-risk category 2 yrs from now.

(b) If this trend continues, what percent of the drivers in the community will be in the low-risk category in the long run?

≈ steady-state

$$TX = X$$

$$\begin{bmatrix} .98 & .78 \\ .02 & .22 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$.98x_1 + .78x_2 = x_1$$
$$.02x_1 + .22x_2 = x_2$$

$$-.02x_1 + .78x_2 = 0$$
$$.02x_1 - .78x_2 = 0$$
$$x_1 + x_2 = 1$$

$$\begin{array}{cc} x_1 & x_2 & \\ \end{array}$$
$$\left[\begin{array}{cc|c} -.02 & .78 & 0 \\ .02 & -.78 & 0 \\ 1 & 1 & 1 \end{array}\right] \xrightarrow{\text{rref}} \left[\begin{array}{cc|c} 1 & 0 & .975 \\ 0 & 1 & .025 \\ 0 & 0 & 0 \end{array}\right]$$

$x_1 = .975$
$x_2 = .025$

97.5% of the drivers will be in the low-risk category in the long run.

2. Perform the next pivot in the Gauss-Jordan method:

$$\left[\begin{array}{ccc|c} 1 & 0 & 2 & 3 \\ 0 & 5 & 6 & 0 \\ 0 & -4 & 3 & -1 \end{array}\right] \xrightarrow{R_2+R_3 \to R_2} \left[\begin{array}{ccc|c} 1 & 0 & 2 & 3 \\ 0 & 1 & 9 & -1 \\ 0 & -4 & 3 & -1 \end{array}\right]$$

$R_2 + R_3$

$[0 \;\; 5 \;\; 6 \;\; 0] + [0 \;\; -4 \;\; 3 \;\; -1]$

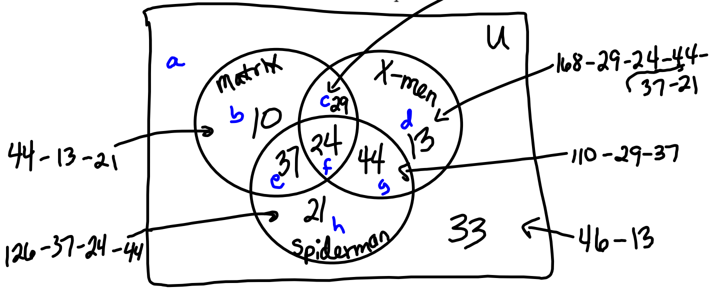
$= [0 \;\; 1 \;\; 9 \;\; -1]$

$$\xrightarrow{R_3+4R_2 \to R_3} \left[\begin{array}{ccc|c} 1 & 0 & 2 & 3 \\ 0 & 1 & 9 & -1 \\ 0 & 0 & 39 & -5 \end{array}\right]$$

2nd pivot is done.

3. A survey of some college students was conducted to see which of the following three movies they had seen: *The Matrix*, *X-Men*, and *Spiderman*. It was found that

24 students had seen all three movies.
110 students had seen exactly 2 of these 3 movies. ← c, e, g
44 students had seen exactly 1 of these 3 movies. b, d, h
37 students had seen only *The Matrix* and *Spiderman*. e
53 students had seen *The Matrix* and *X-men*. c, f
126 students had seen *Spiderman*. e,f,g,h
168 students had seen *X-men* or *Spiderman*. c,d,e,f,g,h 53 − 24 = 29
46 students had seen neither *The Matrix* nor *Spiderman*.



(a) How many students were surveyed?

$$10 + 29 + 13 + 37 + 24 + 44 + 21 + 33 = \boxed{211}$$

(b) How many students surveyed had seen *X-Men* and *Spiderman*?

$$24 + 44 = \boxed{68}$$

(c) How many students surveyed had seen *The Matrix* or *X-Men* but not both?

$$10 + 13 + 37 + 44 = \boxed{104}$$

(d) What is the probability that a randomly selected student from this survey had seen none of the three movies?

$$\frac{33}{211}$$

(e) What is the probability that a randomly selected student from this survey had not seen *Spiderman* but had seen at least one of the other two movies?

$$\frac{10 + 29 + 13}{211} = \boxed{\frac{52}{211}}$$

4. Classify each of the following types of random variables as either finite discrete, infinite discrete, or continuous, and state the possible values of the random variable.

(a) $X =$ the number of black cats being boarded at a kennel that can house at most 45 animals.

$X = 0, 1, 2, \ldots, 45$

finite discrete

(b) $Y =$ the number of gallons of water in a bucket that has a maximum capacity of 5 gallons.

$0 \leq Y \leq 5$

(Y is a real number)

continuous

(c) $Z =$ the number of times my phone rings before I answer it.

$Z = 1, 2, 3, \ldots$

Infinite discrete

5. Amelia wants to save enough money so that she will have \$3,000 to spend on a trip to Europe that she is planning to take in 5 years. If she opens an account paying 6% interest compounded monthly with \$400 and makes monthly deposits for 5 years, what is the size of the monthly payment that will reach her goal?

$N = 12 * 5$

$I\% = 6$

$PV = -400$

$PMT = ? \rightarrow \boxed{\$35.27}$

$FV = 3000$

$P/Y = C/Y = 12$

6. In an experiment, several people are randomly surveyed to find out if they consider themselves to be a Republican, Democrat, or Independent. Each person's response, along with his or her sex, is recorded.

(a) Write an appropriate sample space for this experiment.

$$S = \{(R,M),(D,M),(I,M),(R,F),(D,F),(I,F)\}$$

R - Republican
D - Democrat
I - Independent

M - male
F - female

(b) Write the event that the person surveyed is female.

↑ subset

$$E = \{(R,F),(D,F),(I,F)\}$$

(c) Write the event that the person surveyed considers himself or herself to be an Independent.

$$F = \{(I,M),(I,F)\}$$

(d) Are the events found in (b) and (c) mutually exclusive?

No. $E \cap F = \{(I,F)\}$, so these events can occur at the same time.

7. Consider the propositions

p: Some of the presents are wrapped.
q: All of the guests have arrived.
r: The food is not ready.

and

(a) Write symbolically the statement, "All of the guests have arrived but the food is not ready and none of the presents are wrapped."

$$q \wedge (r \wedge \sim p)$$

(b) Write symbolically the statement, "Either the food is ready or all of the guests have arrived, but not both." ← exclusive

$$\sim r \veebar q$$

(c) Write the statement $(\sim q \vee r) \wedge p$ in English.

Not all of the guests have arrived or the food is not ready, and some of the presents are wrapped.

(d) Write the statement $\sim (r \vee p)$ in English.

$$\sim(r \vee p) = \sim r \wedge \sim p$$

"but" is ok.

The food is ready and none of the presents are wrapped

8. The Capital Two credit card company has found that 23% of its cardholders are late in making their monthly payments. Using the normal approximation to the binomial distribution, find the probability that among 1,500 randomly selected cardholders, at least 340 but fewer than 350 are late in making their payment in a particular month.

X = # of cardholders who are late on pmt.

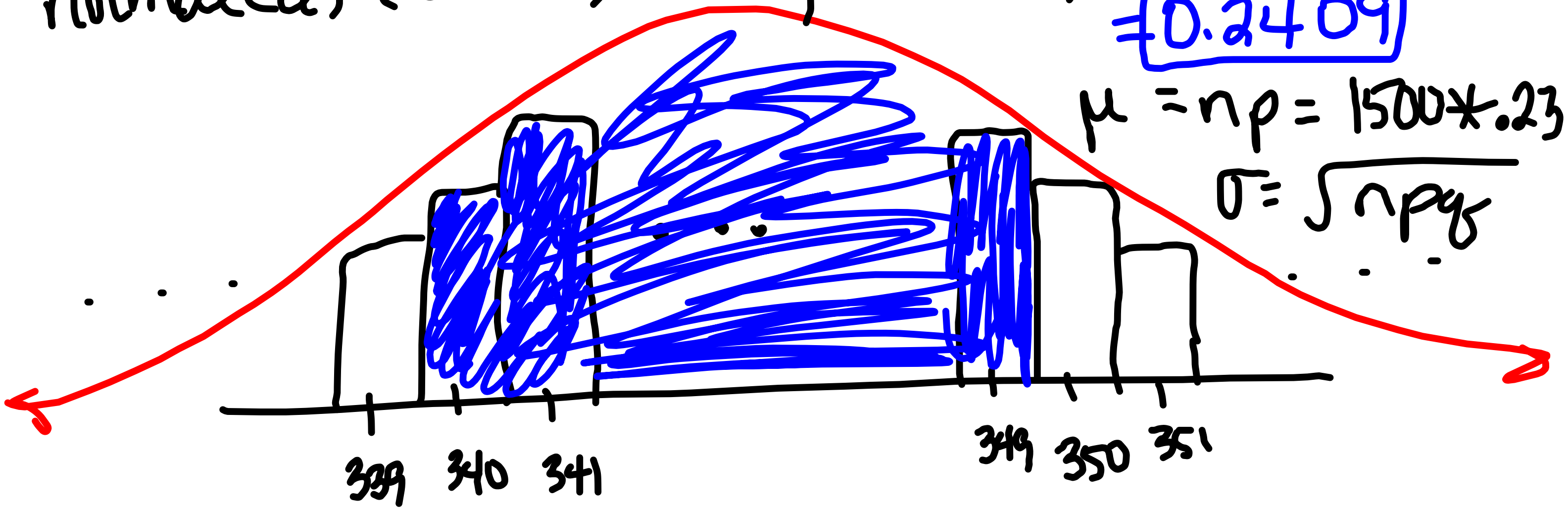
$P(340 \le X < 350) \approx$

normalcdf(339.5, 349.5, 1500*.23, $\sqrt{1500*.23*(1-.23)}$)

$= \boxed{0.2409}$

$\mu = np = 1500*.23$

$\sigma = \sqrt{npq}$



9. Fred, Bob, and Sue are all aliens with extremely long life expectancies. Bob and Sue's combined age in years is only half that of Fred's, and Bob has been alive for three times as many years as Sue. If the three friends' combined ages total 504 years, how old is each alien?

f = Fred's age in years
b = Bob's age in years
s = Sue's age in years.

$$b + s = \tfrac{1}{2}f \qquad\qquad -\tfrac{1}{2}f + b + s = 0$$

$$b = 3s \longrightarrow b - 3s = 0$$

$$f + b + s = 504 \qquad\qquad f + b + s = 504$$

$$\begin{array}{cccc} f & b & s & \\ \multicolumn{4}{c}{\left[\begin{array}{ccc|c} -1/2 & 1 & 1 & 0 \\ 0 & 1 & -3 & 0 \\ 1 & 1 & 1 & 504 \end{array}\right]} \end{array} \xrightarrow{\text{rref}} \begin{array}{cccc} f & b & s & \\ \multicolumn{4}{c}{\left[\begin{array}{ccc|c} 1 & 0 & 0 & 336 \\ 0 & 1 & 0 & 126 \\ 0 & 0 & 1 & 42 \end{array}\right]} \end{array}$$

$f = 336$, $b = 126$, $s = 42$

Fred is 336 years old.
Bob is 126 " " .
Sue is 42 " " .

10. Six people get into an elevator that services 12 floors in a certain building. What is the probability that these 6 people exit the elevator with at least 2 people exiting on the same floor?

E - event that at least 2 of the 6 people exit on the same floor.

E^c - event that all 6 get off on different floors.

$$P(E) = 1 - P(E^c) = 1 - \frac{n(E^c)}{n(S)} = 1 - \frac{P(12,6)}{12^6} = \boxed{\frac{1343}{1728}}$$

$$n(S) = \underset{\substack{1^{st}\\ \text{person}}}{\underline{12}} \cdot \underline{12} \cdot \underline{12} \cdot \underline{12} \cdot \underline{12} \cdot \underset{\substack{6^{th}\\ \text{person}}}{\underline{12}} = 12^6$$

$$n(E^c) = \underset{\substack{1^{st}\\ \text{person}}}{\underline{12}} \cdot \underline{11} \cdot \underline{10} \cdot \underline{9} \cdot \underline{8} \cdot \underset{\substack{6^{th}\\ \text{person}}}{\underline{7}} = P(12,6)$$

11. Construct the truth table for $\sim(p \wedge \sim q) \vee p$.

p	q	$\sim q$	$p \wedge \sim q$	$\sim(p \wedge \sim q)$	$\sim(p \wedge \sim q) \vee p$
T	T	F	F	T	T
T	F	T	T	F	T
F	T	F	F	T	T
F	F	T	F	T	T

12. Bob just bought a house for \$200,000. He made a 15% down payment and financed the balance with a loan that has an interest rate of 5.45%/year compounded monthly.

$.15(200000) = \$30000$ down pmt

(a) If the loan is ammortized for 25 years, what is Bob's monthly payment?

$N = 12*25$

$I\% = 5.45$

$PV = 170{,}000$

$PMT = ?$

$FV = 0$

$P/Y = C/Y = 12$

$\boxed{\$1038.88}$

(b) After 10 years of payments, how much equity has Bob earned on his house?

Equity = Value of house − what you still owe

$= 200000 - 127{,}558.37$

$= \boxed{\$72{,}441.63}$

$N = 12*10$

$I\% = 5.45$

$PV = 170000$

$PMT = -1038.88$

$FV = ?$

$P/Y = C/Y = 12$

$\$127{,}558.37$

(c) How much interest will Bob pay on the loan?

Interest = Total amt pd − value of house

$= (30000 + 1038.88*12*25) - 200000$

$= 341{,}664 - 200000$

$= \boxed{\$141{,}664}$

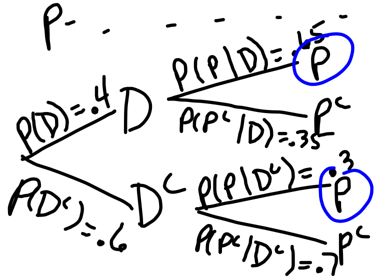
Title: May 2-8:56 AM (12 of 28)

13. Forty percent of all ~~patrons~~ at a local movie theater buy a drink and of those who buy a drink, 65% also buy popcorn. Only 30% of those who do not buy a drink buy popcorn.

(a) What is the probability that a patron who did not buy popcorn did buy a drink?

D - event that a patron buys a drink

P - . . . . popcorn.



$P(D \mid P^c)$

↑ given

$$P(D|P^c) = \frac{P(D \cap P^c)}{P(P^c)} = \frac{(.4)(.35)}{(.4)(.35)+(.6)(.7)} = \boxed{0.25}$$

(b) What is the probability that a patron did buy a drink but did not buy popcorn?

↑ and → intersection

$$P(D \cap P^c) = (.4)(.35) = \boxed{.14}$$

(c) Are the events of buying a drink and buying popcorn independent? Why or wh not?

Test for Indep

$$P(D \cap P) \stackrel{?}{=} P(D)P(P)$$

$$.26 \stackrel{?}{=} (.4)(.44)$$

$$.26 \stackrel{?}{=} .176$$

$P(D) = .4$ (on tree)

$P(P) = (.4)(.65) + (.6)(.3)$
$= .44$

$P(D \cap P) = (.4)(.65) =$
$.26$

No!

$\boxed{\text{Not independent}}$

Title: May 2-8:57 AM (13 of 28)

14. If A is a 4×4 singular matrix, B is a 2×4 matrix, C is a 4×5 matrix, and D is a 5×4 matrix, which of the following are possible? If the operation IS possible, give the size of the resulting matrix. If the operation is NOT possible, explain why.

(a) BA

Size of B Size of A

2x4 = ✓ 4x4

2x4

$\boxed{\text{BA is } 2\times 4}$

(b) $A^T C + D$

A^T C ADD D

4x4 ✓ 4x5 + 5x4

=

4x5

Not possible - must be same size to add.

(c) $CD - 5A$

C D ✓ Subtract 5A

4x5 5x4 4x4

✓=

4x4

$\boxed{\text{CD} - 5\text{A is } 4\times 4.}$

(d) $A^{-1}(CD)^T$

Not possible: A is singular, so A does not have an inverse.

15. A drawer contains 5 white socks and 7 black socks. (Assume that all white socks coordinate with each other, and all black socks coordinate with each other.) A sample of 4 socks is drawn (without replacement) from the drawer. Let X equal the number of matching pairs in the sample.

(a) Write the probability distribution for X.

Outcomes	# of Matching Pairs
4 White, 0 Black	2
3 White, 1 Black ←	1
2 White, 2 Black	2
1 White, 3 Black ←	1
0 White, 4 Black	2

Value of X	$P(X=x)$
1	$\frac{49}{99}$
2	$\frac{50}{99}$

$$P(X=1) = P(3W,1B \text{ or } 1W,3B) = P(3W,1B) + P(1W,3B)$$

$$= \frac{C(5,3)C(7,1)}{C(12,4)} + \frac{C(5,1)C(7,3)}{C(12,4)}$$

$$P(X=1) = \frac{49}{99} \qquad P(X=2) = 1 - \frac{49}{99} = 50/99$$

(b) How many matching pairs of socks can you expect to have in the sample?

$$E(X) = 1\left(\frac{49}{99}\right) + 2\left(\frac{50}{99}\right) = \frac{149}{99} \approx \boxed{1.5051}$$

16. The odds in favor of the event A are 2:3. The odds in favor of the event B are 4:3. If A and B are mutually exclusive events, find the probability that A or B occurs.

$P(A \cap B) = 0$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$= \frac{2}{2+3} + \frac{4}{4+3} - 0$$

$$= \frac{2}{5} + \frac{4}{7} = \boxed{\frac{34}{35}}$$

17. Several snack-sized bags of M&M's were examined to determine the number of M&M's in each package. The results of the study are given in the table below.

number of packages	5	0	4	2	7 ← L_2
$X =$ number of M&M's	10	13	11	9	15 ← Type into L_1

(a) What should the random variable X represent, number of packages or number of M&M's?

$X =$ # of M&M's

(b) Give each of the following for this data set. Round to 4 decimal places when necessary.

1 Varstats L_1, L_2

i. E(X) = 12.0556 $= \bar{x}$

ii. [redacted] variance = ____ → Mrs. Ramsey's Class: this is a sample so $s_x^2 = 6.1732$.

All other classes: Just use $\sigma_x^2 = 5.8302$.

iii. mode = 15

iv. median = 11

18. Solve the following system of equations:
$$\begin{array}{rcrcrcr} x & - & 2y & + & z & = & -3 \\ 2x & + & y & - & 2z & = & 2 \\ -2x & + & 4y & - & 2z & = & 6 \end{array}$$

$$\left[\begin{array}{ccc|c} 1 & -2 & 1 & -3 \\ 2 & 1 & -2 & 2 \\ -2 & 4 & -2 & 6 \end{array}\right] \xrightarrow{rref} \begin{array}{c} \begin{array}{cccc} x & y & & \end{array} \\ \left[\begin{array}{ccc|c} 1 & 0 & -3/5 & 1/5 \\ 0 & 1 & -4/5 & 8/5 \\ 0 & 0 & 0 & 0 \end{array}\right] \end{array} \quad z=t$$

$y-\frac{4}{5}z=\frac{8}{5}$

$y=\frac{4}{5}z+\frac{8}{5}$

$x-\frac{3}{5}z=\frac{1}{5}$

$x=\frac{3}{5}z+\frac{1}{5}$

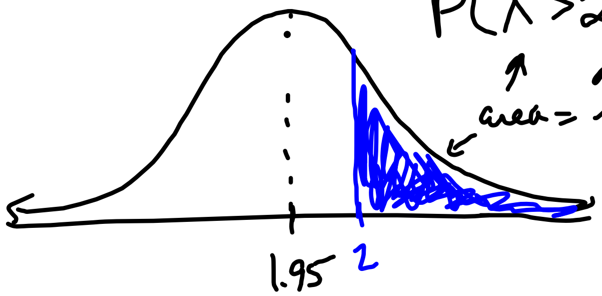
Let $z=t$ where t is any real #. The parametric solution is

$(x,y,z)=\left(\frac{3}{5}t+\frac{1}{5}, \frac{4}{5}t+\frac{8}{5}, t\right).$

There are infinitely many solutions.

19. The true volume of soda in 2-liter bottles packaged by Acme, Inc. is normally distributed with a mean of 1.95 L and a standard deviation of 0.35 L.

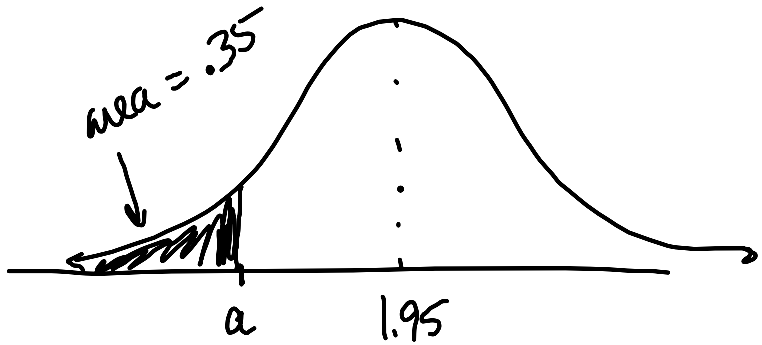
(a) Find the probability that a randomly selected bottle contains more than 2 L of soda.



$P(X>2) = \text{normalcdf}(2, 1E99, 1.95, .35)$

$= \boxed{.4432}$

(b) 35% of all bottles contain a volume that is less than __a__ liters.



$a = \text{invnorm}(.35, 1.95, .35)$

$\boxed{a = 1.8151}$

20. Solve for x, y, z, and w in the following matrix equation:

$$\begin{bmatrix} x & 2z \\ 1 & 3 \end{bmatrix}\begin{bmatrix} 2 & y \\ -1 & 0 \end{bmatrix} + \begin{bmatrix} -8 & w \\ 0 & -2 \end{bmatrix}^T = \begin{bmatrix} -4 & 12 \\ 5 & 10 \end{bmatrix}$$

$\underbrace{2\times 2 \quad 2\times 2}_{2\times 2}$

$$\begin{bmatrix} 2x-2z & xy+0 \\ 2-3 & y+0 \end{bmatrix} + \begin{bmatrix} -8 & 0 \\ w & -2 \end{bmatrix} = \begin{bmatrix} -4 & 12 \\ 5 & 10 \end{bmatrix}$$

$$\begin{bmatrix} 2x-2z-8 & xy \\ -1+w & y-2 \end{bmatrix} = \begin{bmatrix} -4 & 12 \\ 5 & 10 \end{bmatrix}$$

$2x-2z-8=-4$

$2(1)-2z=4$

$-2z=2$

$\boxed{z=-1}$

$xy=12$

$12x=12$

$\boxed{x=1}$

$-1+w=5$

$\boxed{w=6}$

$y-2=10$

$\boxed{y=12}$

21. How many ways can 4 red crayons, 6 blue crayons, and 5 yellow crayons be lined up in a row if crayons of the same color are identical?

$$\frac{n!}{n_1!\,n_2!\cdots n_r!} = \frac{15!}{4!\cdot 6!\cdot 5!} = \boxed{630{,}630}$$

$$15!/(4!6!5!)$$

22. Elliot wants to buy Olivia 8 movies for her birthday. Olivia has given Elliot a list of 15 different movies that she would like to have, but Elliot left the list at home. How many ways can Elliot randomly choose 8 movies off a shelf that has 35 different movies (15 of which are on Olivia's list) and get at least 7 movies that are on the list?

E - event that Elliot chooses at least 7 that are on the list.

Exactly 7 + Exactly 8

$$n(E) = C(15,7)C(20,1) + C(15,8)$$

$$= \boxed{135,135}$$

23. A random variable X has a mean of 34 and a standard deviation of 2.5. Use Chebychev's inequality to estimate $P(28.75 \le X \le 39.25)$.

$$\begin{array}{r} 34 \\ -\ 28.75 \\ \hline 5.25 \end{array} \qquad \begin{array}{r} 39.25 \\ -\ 34 \\ \hline 5.25 \end{array}$$

$$5.25 = 2.5k$$

$$2.1 = k$$

at least

$$P(28.75 \le X \le 39.25) \ge 1 - \frac{1}{(2.1)^2} = \boxed{\frac{341}{441}}$$

24. Let $U = \{a,b,c,d,e,1,2,3,4,5\}$, and let $A = \{a,c,e,3,5\}$, $B = \{1,2,4,d\}$, and $C = \{c,e,3\}$. Which of the following are true?

(a) A and B are disjoint. TRUE

$A \cap B = \emptyset$

(b) $\{a,2,5\} \subseteq B \cup C^c$ TRUE

$C^c = \{a,b,d,1,2,4,5\}$

$B = \{1,2,4,d\}$

$B \cup C^c = \{a,b,d,1,2,4,5\}$

(c) $e \subset C$ FALSE

proper subset

(d) $\{c,e,3\} \in \{a,c,e,3,5\}$ FALSE

$\subset$ That would make it true.

(e) A has 32 subsets. TRUE.

$2^n = 2^5 = 32$

(f) $(A \cap C)^c = \{3,5\}$ False.

$A \cap C = \{c,e,3\}$

25. How much should Bob invest now in a savings account paying 2.25%/year compounded daily so that at the end of 10 years he has $25,000 in the account?

$N = 365 * 10$ $PMT = 0$

$I\% = 2.25$ $FV = 25000$

$PV = ?$ $P/Y = C/Y = 365$

Deposit $\boxed{\$19,963.04}$

26. According to company records, 24% of all customers at Acme Hardware on any particular day buy caulk. Find the probability that among 35 randomly selected customers, at most 7 buy caulk that day.

Binomial

1) $n = 35$

2) "success" - buying caulk

3) $p = .24$

4) Indep ✓

$P(X \le 7)$

$= \text{binomcdf}(35, .24, 7)$

$= \boxed{0.3728}$

BINOM Program

$n = 35$

$p = .24$

Option 2

Lower R = 0

Upper R = 7

27. Roy and Clarice play a game in which they each flip a coin at the same time. If both coins land heads, Roy pays Clarice \$2. If both coins land tails, then Clarice pays Roy \$3. If Roy gets heads and Clarice gets tails, Clarice pays Roy \$5. Otherwise, Roy pays Clarice \$6.

(a) Write the payoff matrix for this two-person zero-sum game.

Clarice

$$\text{Roy}\quad \begin{array}{c|cc|l} & H & T & \\ \hline H & -2 & 5 & -2 \leftarrow R_1 \\ T & -6 & 3 & -6 \\ \hline & -2 & 5 & \\ & \uparrow C_1 & & \end{array}$$

(b) Find the maximin and minimax strategies for the row and column players, respectively.

Maximin for Roy: Row 1

Minimax for Clarice: Column 1.

(c) Is this game strictly determined? If yes, find the saddle point and state the value of the game.

Yes. There is a saddle point in a_{11}, so the value of the game is -2. (It favors Clarice.)

28. (Section 9.5) Let $A = \begin{bmatrix} 4 & 2 \\ -5 & 6 \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be the payoff matrix for a two-person, zero-sum game. ← I changed this!!!

(a) Find the optimal mixed strategies for each player.

$P = [p_1 \quad p_2]$ $p_1 = \frac{d-c}{a+d-b-c} = \frac{6+5}{4+6-2+5}$

$p_1 = \frac{11}{13}$

$p_2 = 1 - \frac{11}{13} = \frac{2}{13}$

Row player's optimal mixed strategy is

$P = [\frac{11}{13} \quad \frac{2}{13}]$.

$Q = \begin{bmatrix} q_1 \\ q_2 \end{bmatrix}$ $q_1 = \frac{d-b}{a+d-b-c} = \frac{6-2}{4+6-2+5} = \frac{4}{13}$

$q_2 = 1 - \frac{4}{13} = \frac{9}{13}$

Column player's optimal mixed strategy is

$Q = \begin{bmatrix} 4/13 \\ 9/13 \end{bmatrix}$.

(b) Find the expected payoff to the row player if both players use their optimal mixed strategies.

Always works: $E = PAQ$

In this case we can use

$E = \frac{ad-bc}{a+d-b-c} = \frac{(4)(6)-(2)(-5)}{4+6-2+5}$

$= \frac{34}{13} \approx 2.62$

The row player can expect to win \$2.62 per play on average.