Math 166 - Exam 3 Review

NOTE: For reviews of the other sections on Exam 3, refer to the first page of WIR #7 and #8.

Section 8.2 - Expected Value

- Average, or Mean - The average, or mean, of the n numbers $x_1, x_2, \dots, x_n$ is $\bar{x}$, where $\bar{x} = \dfrac{x_1 + x_2 + \cdots + x_n}{n}$.
- Expected Value of a Random Variable X - Let X denote a random variable that assumes the values $x_1, x_2, \dots, x_n$ with associated probabilities $p_1, p_2, \dots, p_n$, respectively. Then the *expected value* of X, written $E(X)$, is given by the following formula: $E(X) = x_1 p_1 + x_2 p_2 + \cdots + x_n p_n$.
- If $P(E)$ is the probability of an event E occurring, then the odds in favor of E occurring are $\dfrac{P(E)}{P(E^c)}$, and the odds against E occurring are $\dfrac{P(E^c)}{P(E)}$.
- Whenever possible, odds are expressed as ratios of whole numbers. If the odds in favor of E are $\dfrac{a}{b}$, we say the odds in favor of E are a to b (or $a:b$). If the odds against E occurring are $\dfrac{b}{a}$, we say the odds against E are b to a (or $b:a$).
- If the odds in favor of an event E occurring are a to b, then the probability of E occurring is $P(E) = \dfrac{a}{a+b}$.

- **Median** - The median is the middle value in a set of data arranged in increasing or decreasing order (when there is an odd number of entries). If there is an even number of entries, the median is the average of the two middle numbers.
- **Mode** - The mode is the value that occurs most frequently in the set of data.

Section 8.3 - Variance and Standard Deviation

- **Variance of a Random Variable** X - The variance of a random variable X is one measure of dispersion (spread) of a probability distribution about its mean. The units of variance are the square of the units of the random variable.
- Standard Deviation of a Random Variable X - The standard deviation of a random variable X is another measure of dispersion (spread) of a probability distribution about its mean. The units of standard deviation are the same as the units of the random variable.
- Chebychev's Inequality - Let X be a random variable with expected value μ and standard deviation σ. Then the probability that a randomly chosen outcome of the experiment lies between $\mu - k\sigma$ and $\mu + k\sigma$ is at least $1 - \dfrac{1}{k^2}$; that is, $P(\text{outcome is within } k \text{ standard deviations of } \mu) \geq 1 - \frac{1}{k^2}$.

Section 8.3 - Variance and Standard Deviation

- A *binomial experiment* has the following properties:
  1. The number of trials in the experiment is fixed.
  2. There are two outcomes of the experiment: "success" and "failure."
  3. The probability of success in each trial is the same.
  4. The trials are independent of each other.

- **Notation:** In a binomial experiment it is customary to denote the probability of a success by the letter p and the probability of failure by the letter q.

- Computation of Probabilities in Bernoulli Trials - In a binomial experiment in which the probability of success in any trial is p, the probability of exactly r successes in n independent trials is given by $C(n,r)p^r q^{n-r}$.
- If X is a binomial random variable associated with a binomial experiment consisting of n trials with probability of success p and probability of failure q, then the **mean** (expected value), **variance**, and **standard deviation** of X are

$$\begin{aligned} \mu &= E(x) = np \\ \text{Var}(X) &= \sigma_x{}^2 = npq \\ \sigma_x &= \sqrt{npq} \end{aligned}$$

Title: Nov 13-5:57 PM (1 of 22)

1. Is the following statement correct? "The probability that Kurt spends less than \$15 on a new DVD is 0.4. Therefore the probability that Kurt spends more than \$15 on a new DVD is 0.6."

No. We cannot exclude the possibility that he spends exactly \$15.

The correction of this statement would read, " The probability that Kurt spends less than \$15 on a new DVD is .4, so the probability that he spends \$15 or more on a new DVD is .6."

(The complement of less than 15 is greater than or equal to 15.)

2. A fair 4-sided die and a fair 5-sided die are rolled. What is the probability that

(a) the sum of the dice is 4 or 8?

union

A- Sum is 4

B- Sum is 8

(1,1)(1,2)(1,3)(1,4)(1,5)

(2,1)(2,2)(2,3)(2,4)(2,5)

(3,1)(3,2)(3,3)(3,4)(3,5)

(4,1)(4,2)(4,3)(4,4)(4,5)

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
$$= \frac{3}{20} + \frac{2}{20} - 0$$
$$= \boxed{\frac{5}{20}}$$

(b) the sum of the dice is 8 or at least one 3 is showing?

C- at least one 3 is showing

$$P(B \cup C) = P(B) + P(C) - P(B \cap C)$$
$$= \frac{2}{20} + \frac{8}{20} - \frac{1}{20}$$
$$= \boxed{\frac{9}{20}}$$

(c) the sum of the dice is 6 if the 5-sided die shows an even number?

given

D - Sum is 6

E - 5-sided die shows an even #.

$$P(D \mid E) = \frac{P(D \cap E)}{P(E)} = \frac{2/20}{8/20} = \frac{2}{8} = \boxed{\frac{1}{4}}$$

given

$$P(D \cap E) = 2/20$$

(d) the sum of the dice is 6 provided that exactly one 2 is showing? given

F- exactly one 2 is showing

$$P(D \mid F) = \frac{P(D \cap F)}{P(F)}$$
$$= \frac{2/20}{7/20}$$
$$= \boxed{\frac{2}{7}}$$

3. Are mutually exclusive events and independent events the same thing?

Mutually Excl – the events cannot occur at the same time (no outcomes in common.) $\longrightarrow P(A \cap B) = 0$

Indep. events do not affect each other.

$$P(A \cap B) = P(A)P(B)$$

Also for Independent events, $P(A|B) = P(A)$ and $P(B|A) = P(B)$.

4. Jack and Jill are two weather forcasters in Gonzales. The probability that Jack accurately predicts the weather on any given day is 0.68, and the probability that Jill accurately predicts the weather on any given day is 0.72. If the probability that at least one of them is correct on any given day is 0.89, are Jack and Jill making their weather predictions independently? ← Test for independence $P(A \cap B) \stackrel{?}{=} P(A)P(B)$

A – event that Jack accurately predicts the weather.

B – – – – – Jill – – –

$P(A) = .68$

$P(B) = .72$

$P(A \cup B) = .89$

This info was given in the problem

union b/c "at least one" means 1 or more (or = union)

Find $P(A \cap B)$:

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

$$.89 = .68 + .72 - P(A \cap B)$$

$$P(A \cap B) = .51$$

Test

$$P(A \cap B) \stackrel{?}{=} P(A)P(B)$$

$$.51 \stackrel{?}{=} (.68)(.72)$$

$$.51 \neq .4896$$

$\boxed{\text{not indep!}}$

5. Madison has 5 red, 7 yellow, and 4 blue crayons in her desk drawer. If she selects two at random, what is the probability that she will get two of the same color?

choose

E - event that 2 crayons of the same color are drawn.

$$P(E) = \frac{n(E)}{n(S)} = \boxed{\frac{C(5,2)+C(7,2)+C(4,2)}{C(16,2)}}$$

n(E): 2 red or 2 yellow or 2 blue

$C(5,2) + C(7,2) + C(4,2)$

6. A local business employs 12 cashiers, 3 shift managers, and 5 stockers. Two employees are selected at random to attend a workshop.

(a) What is the probability that the first employee selected is a cashier?

$$\frac{12}{20}$$

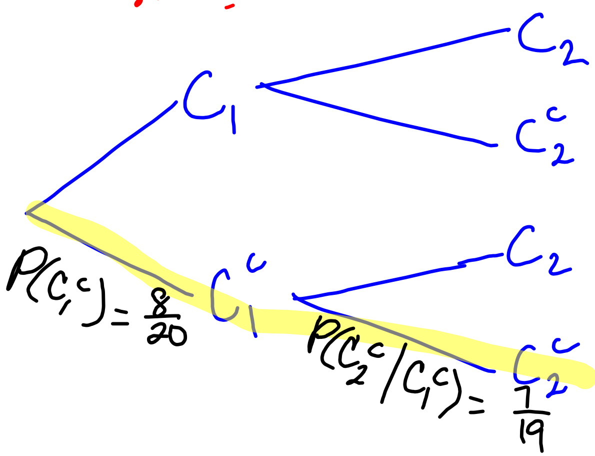
(b) Assuming that the first employee selected is a cashier, what is the probability that the second employee selected is a cashier?

$$\frac{11}{19}$$

(c) What is the probability that neither the first nor the second employee selected is a cashier?

C_1 - event the 1st employee selected is a cashier.

C_2 - - - - 2nd - - - -



$$P(C_1^c \cap C_2^c) = \left(\frac{8}{20}\right)\left(\frac{7}{19}\right)$$

$$= \boxed{\frac{14}{95}}$$

7. A manufacturer of automobiles receives 500 car radios from each of three different suppliers. The shipment from supplier A contains 5 defective radios, the shipment from supplier B contains 7 defective radios, and the shipment from supplier C contains 2 defective radios. As a means of quality control, one radio is selected at random from each of the shipments. What is the probability that

(a) all of the radios selected are working properly?

D_A - event that the radio from A is defective

D_B - - - - - - - - - B - .

D_C . - - - - - C

Indep? yes!!!

$P(D_A^c \cap D_B^c \cap D_C^c)$

$= P(D_A^c)P(D_B^c)P(D_C^c) = (1-\frac{5}{500})(1-\frac{7}{500})(1-\frac{2}{500})$

$= \boxed{.9722}$

(b) at least one of the radios selected is defective?

$P(\text{at least 1 defective}) = 1 - P(\text{0 defectives})$

$= 1 - .9722$

$= \boxed{.0278}$

(c) exactly one of the selected radios is defective?

$P(D_A \cap D_B^c \cap D_C^c) = (\frac{5}{500})(\frac{493}{500})(\frac{498}{500})$

$+ \qquad +$

$P(D_A^c \cap D_B \cap D_C^c) = (\frac{495}{500})(\frac{7}{500})(\frac{498}{500})$

$+ \qquad +$

$P(D_A^c \cap D_B^c \cap D_C) = (\frac{495}{500})(\frac{493}{500})(\frac{2}{500})$

$= \boxed{.0275}$

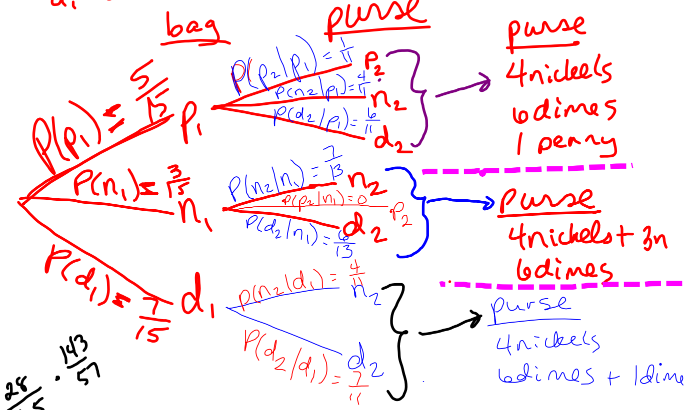
8. A bag contains 5 pennies, 3 nickels, and 7 dimes. A purse contains 4 nickels and 6 dimes. A coin is drawn from the bag and transferred to the purse, but if a nickel is selected from the bag, then all of the nickels in the bag are transferred to the purse. A coin is then drawn from the purse. The type of coin drawn from each of the bag and purse is recorded. What is the probability that

(a) the transferred coin was a dime if a nickel was selected from the purse?

given

$$P(d_1 | n_2) = \frac{P(d_1 \cap n_2)}{P(n_2)}$$

p_1 - penny 1st
n_1 - nickel 1st
d_1 - dime 1st



$\frac{28}{165} \cdot \frac{143}{57}$

$$P(d_1 | n_2) = \frac{P(d_1 \cap n_2)}{P(n_2)}$$

$$= \frac{(\frac{7}{15})(\frac{4}{11})}{(\frac{5}{15})(\frac{4}{11}) + (\frac{3}{15})(\frac{7}{13}) + (\frac{7}{15})(\frac{4}{11})}$$

$$= \boxed{\frac{364}{855}}$$

(b) both coins are pennies?

$$P(p_1 \cap p_2) = \left(\frac{5}{15}\right)\left(\frac{1}{11}\right) = \frac{5}{165} = \boxed{\frac{1}{33}}$$

(c) the coin drawn from the purse is a penny if the coin drawn from the bag was a nickel?

given

$$P(p_2 | n_1) = \frac{P(p_2 \cap n_1)}{P(n_1)}$$

$$= \frac{(\frac{3}{15})(0)}{P(n_1)} = \boxed{0}$$

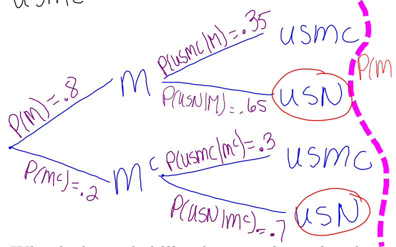
9. A naval academy has a student body that is 80% male. 35% of the males and 30% of the females plan to seek a commission in the United States Marine Corps, and all other students plan to seek a commission in the United States Navy.

(a) What is the probability that a student at this academy is male or plans to seek a commission in the Navy?

M - event the student is male

USN - event the student plans to join the US Navy.

usmc - - - - - - - - - - - - . . . . US Marine Corps.



or = union

$$P(M \cup USN) = P(M) + P(USN) - P(M \cap USN)$$

$$= .8 + (.8)(.65) + (.2)(.7) - (.8)(.65)$$

$$= \boxed{0.94}$$

(b) What is the probability that a student who plans to seek a commission in the Marine Corps is female?

$$P(M^c \mid usmc) = \frac{P(M^c \cap usmc)}{P(usmc)}$$

$$= \frac{(.2)(.3)}{(.8)(.35) + (.2)(.3)}$$

$$= \boxed{\frac{3}{17}}$$

(c) What is the percentage of students at this academy who plan to join the Marine Corps?

First find the probability:

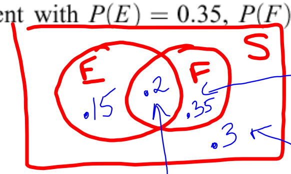
$$P(usmc) = (.8)(.35) + (.2)(.3)$$

$$= .34$$

$\boxed{\text{34\% plan to join the USMC.}}$

Title: Nov 13-6:01 PM (9 of 22)

10. Let E and F be two events of an experiment with $P(E) = 0.35$, $P(F) = 0.55$, and $P(E \cap F^c) = 0.15$.



$.55 - .2 = .35$

$1 - .15 - .2 - .35$

(a) Find $P(E \cap F)$.

$\boxed{.2}$

(b) What is the probability that exactly one of these two events occurs?

$.15 + .35 = \boxed{.5}$

$.35 - .15 = .2$

(c) Are E and F mutually exclusive?

No! It is possible for E and F to occur at the same time $(P(E \cap F) \neq 0)$

(d) Are E and F independent?

Test

$P(E \cap F) \stackrel{?}{=} P(E)P(F)$

$.2 \stackrel{?}{=} (.35)(.55)$

$.2 \neq .1925$ $\boxed{\text{not indep.}}$

(e) Find $P(E|F)$.

$P(E|F) = \frac{P(E \cap F)}{P(F)} = \frac{.2}{.55} = \boxed{\frac{4}{11}}$

(f) Find the probability that at least one of the two events occurs.

1 or more

union

$P(E \cup F) = P(E) + P(F) - P(E \cap F)$

$= .35 + .55 - .2$

$= \boxed{.7}$

11. Classify each of the following random variables and give the possible values they each may assume.

(a) X = the number of times a coin is flipped until tails appears.

$X = 1, 2, 3, 4, \ldots$ infinite discrete

(b) X = the number of cards drawn (without replacement) from a standard deck of 52 playing cards until a red card is drawn.

$X = 1, 2, 3, \ldots, 27$ finite discrete

(c) X = the weight of a newborn baby.

$X > 0$ continuous

(d) X = the number of hours my cat Mouse sleeps in one day.

$0 \leq X \leq 24$ continuous.

(e) Cards are drawn one at a time with replacement from a well-shuffled deck of 52 playing cards until a club is drawn. Let X = the number cards drawn in the experiment.

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

Inf. discrete.

12. 16 people are selected at random. What is the probability that at least 2 of the people in this group

(a) were born in the same week? (There are 52 weeks in a year. Assume that all weeks are equally likely.)

E - event that at least 2 are born in the same week

$P(E) = 1 - P(E^c)$ where E^c is the event that they are all born in different weeks

$$P(E) = 1 - P(E^c)$$
$$= 1 - \frac{n(E^c)}{n(S)}$$
$$= \boxed{1 - \frac{P(52,16)}{52^{16}}}$$

$n(S)$: $\underline{52}\ \underline{52}\ \underline{52} \cdots\cdots \underset{16^{th}\text{ person}}{\underline{52}} = 52^{16}$

Note the change from what was written at the review Monday night

$n(E^c) = \underset{1st}{\underline{52}}\ \underset{2nd}{\underline{51}}\ \underset{3rd}{\underline{50}} \cdots\cdots \underset{16^{th}\text{ blank}}{\underline{37}} = P(52,16)$

16 blanks

still correct

$P(n,r) = \frac{n!}{(n-r)!}$

(b) were born in the same month? (Assume that all months are equally likely.)

G - event that at least 2 were born in the same month.

G^c - event that none were born in the same month.

$$P(G) = 1 - P(G^c)$$
$$= 1 - \frac{n(G^c)}{n(S)}$$
$$= 1 - \frac{0}{n(S)} = \boxed{1}$$

note the change in answer from what I wrote at the review Monday night.

$n(G^c) = \underset{1st}{\underline{12}} \cdot \underset{2nd}{\underline{11}} \cdot \underline{10} \cdot \underline{9} \cdots\cdots \underset{16th}{\underline{0}} = 0$

13. The odds against it snowing in College Station next winter are 17 to 2. What is the probability that it will snow in College Station next winter?

a to b

one way to work this problem:

$\frac{a}{a+b}$ } How to go from odds of an event to the probab. of that same event.

$$\frac{2}{17+2} = \boxed{\frac{2}{19}}$$

Another way:

$\frac{17}{17+2} = \frac{17}{19}$ = probab that it does not snow

Probab it does $= 1 - \frac{17}{19} = \boxed{\frac{2}{19}}$

14. Two cards are drawn at random from a standard deck of 52 playing cards. What are the odds that the second card drawn is a king given that the first card drawn was a queen?

odds in favor: $\frac{P(E)}{P(E^c)} \rightarrow \frac{a}{b}$

a to b
a:b

So we must calculate the probability of the event first:

$P(2^{nd} \text{ is king} \mid 1^{st} \text{ is queen}) = \frac{4}{51}$

4 kings left

only 51 cards left

odds in favor of this: $\frac{\frac{4}{51}}{1-\frac{4}{51}} = \frac{4}{47} \rightarrow \boxed{4 \text{ to } 47}$

or

4:47

15. A probability distribution has a mean of 100 and a standard deviation of 4. Use Chebychev's Theorem to estimate the probability that an outcome of the experiment lies between 90 and 110.

2.5

$P(\text{within } k \text{ std.dev's of } \mu) \geq 1 - \frac{1}{k^2}$

$\mu = 100$

difference $= \sigma k$

$$\begin{array}{r} 110 \\ -100 \\ \hline 10 \end{array} \qquad \begin{array}{r} 100 \\ -90 \\ \hline 10 \end{array}$$

↑ difference

$10 = 4k$

$2.5 = k$

$P(90 \leq X \leq 110) \geq 1 - \frac{1}{(2.5)^2} = \boxed{.84}$

$\mu - k\sigma \leq X \leq \mu + k\sigma$

16. Fred wants to purchase a 10-year term life insurance policy that will pay his beneficiary \$100,000 in the event that Fred does not survive the next 10 years. Using life insurance tables, he determines that the probability that he will live another 10 years is 0.97. What is the minimum amount that he can expect to pay for his premium?

A = min amt. he can expect to pay for the premium.

min premium is the premium that makes the insurance company's $\boxed{\text{expected gain} = 0}$

$0 = E(X) = x_1p_1 + x_2p_2 + \cdots$

goal

X = the insurance company's gain

	Value of X	$P(X=x)$
(lives)	A	.97
(dies)	A − 100,000	.03

$E(X) = 0 = .97A + .03(A - 100000)$

$0 = .97A + .03A - 3000$

$0 = A - 3000$

$\boxed{\$3000 = A}$

This problem is similar to #16 and #18 in Section 6.2.

17. Suppose you roll two fair 6-sided dice and take the sum of the numbers landing up. You will win twice what you paid if the sum is 7 or 11. You ~~lose what you paid~~ win nothing if the sum is 2, 3, or 12. For any other sum, you win \$5. The game costs \$10 to play. Let X denote the net winnings of someone who plays once.

winnings − cost to play.

edit this

(a) What is the expected net winnings?

$$E(X) = x_1p_1 + x_2p_2 + \cdots + x_np_n$$

Win	Outcome	Value of X	$P(X=x)$
\$20	7 or 11	10	$\frac{8}{36}$
\$0	2, 3, or 12	−10	$\frac{4}{36}$
\$5	anything else	−5	$1-\frac{8}{36}-\frac{4}{36}=\frac{24}{36}$

$$E(X) = 10\left(\frac{8}{36}\right) + (-10)\left(\frac{4}{36}\right) + (-5)\left(\frac{24}{36}\right)$$

$$= -\$2.22$$

(b) How much should be charged to make this game fair?

A = amt that should be charged to make the game fair

fair game − expected net winnings = 0.

Win		Value of X	$P(X=x)$
2A	7 or 11	$2A - A = A$	$\frac{8}{36}$
0	2, 3 or 12	$-A$	$\frac{4}{36}$
\$5	anything else	$5 - A$	$\frac{24}{36}$

$$E(X) = 0$$

$$0 = \frac{8}{36}A + \frac{4}{36}(-A) + \frac{24}{36}(5-A)$$

$$0 = \frac{8}{36}A - \frac{4}{36}A + \frac{120}{36} - \frac{24}{36}A$$

$$0 = -\frac{5}{9}A + \frac{10}{3}$$

$$\frac{5}{9}A = \frac{10}{3}$$

$$\boxed{A = \$6}$$

18. A cashier at a convenience store kept a record of the number of items purchased by each customer on one day. The data she collected are summarized in the following table:

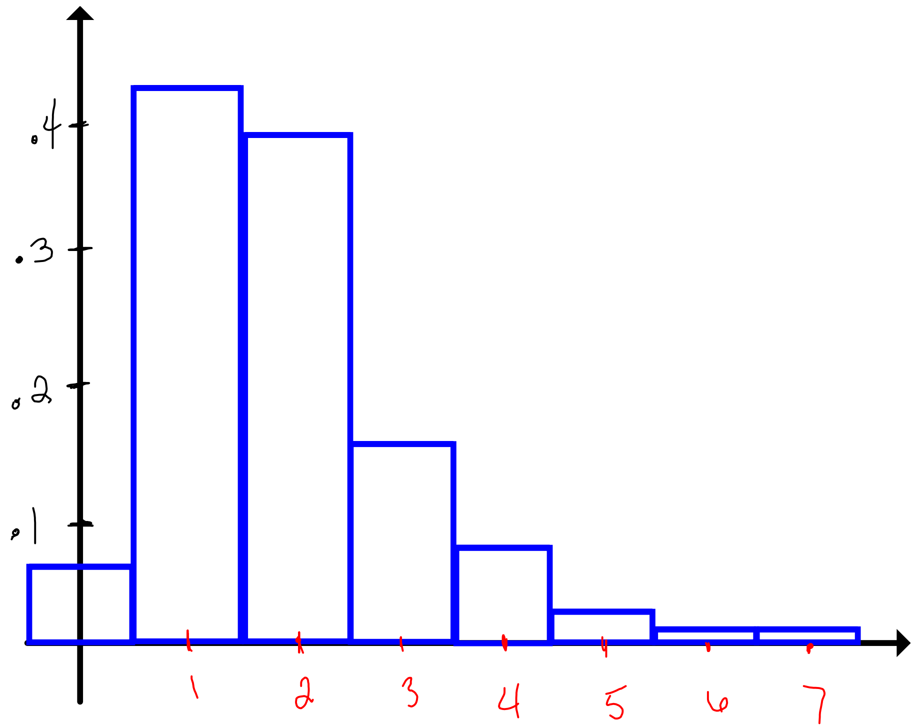
frequencies **Number of customers**	5	25	22	13	7	2	1	1
X = **Number of items purchased**	0	1	2	3	4	5	6	7

← Total = 76

(a) Write the probability distribution of the number of items purchased. ← X = # of items purchased

Value of X	0	1	2	3	4	5	6	7
$P(X=x)$	$\frac{5}{76}$	$\frac{25}{76}$	$\frac{22}{76}$	$\frac{13}{76}$	$\frac{7}{76}$	$\frac{2}{76}$	$\frac{1}{76}$	$\frac{1}{76}$

(b) Draw a histogram associated with the probability distribution found in part (a).



(c) Find $P(2 \leq X \leq 4)$. $= P(X=2) + P(X=3) + P(X=4)$

$$= \frac{22}{76} + \frac{13}{76} + \frac{7}{76} = \boxed{\frac{42}{76}}$$

(d) Find $P(X < 5)$.

$$1 - \left(\frac{2}{76} + \frac{1}{76} + \frac{1}{76}\right) = \frac{72}{76}$$

E(x)

(e) How many items could a customer on that day be expected to buy?

$E(X) = \bar{x} = 2.0921$

1 var stats L_1, L_2

(f) Compute the mean, median, mode, standard deviation, and variance for the frequency chart. Be sure to label all answers.

assuming this is a sample,

$\bar{x} = 2.0921$

median = 2

mode = 1

sample $s_x = 1.3873$ = standard deviation

sample $s_x^2 = 1.9247$ = variance

Note: Some instructors ALWAYS use σ_x for standard deviation:

(population) $\sigma_x = 1.3782$ = standard deviation

(population) $\sigma_x^2 = 1.8994$ = variance

19. A student takes a 10 question multiple choice exam, each question of which has 5 answer choices (1 correct, 4 incorrect). Being unprepared for the exam, the student randomly guesses at each question.

X = the # of successes

(a) What is the probability that the student gets exactly 6 questions correct?

$n = 10$

"success" - getting a question correct.

$p = \frac{1}{5}$

Indep ✓

BINOM option 1

$n = 10$
$p = \frac{1}{5}$
$R = 6$

$\boxed{P(X=6) = .0055}$

$P(X=6)$ exact # of successes

$\hookrightarrow \text{binompdf}(10, \frac{1}{5}, 6)$

$= \boxed{.0055}$

(b) What is the probability that the student gets at least 60% of the questions correct?

60% of 10 = 6 → $\underbrace{\text{at least } 6}_{6 \text{ or more}}$ correct

$P(6 \le X \le 10)$

$= 1 - \text{binomcdf}(10, \frac{1}{5}, 5)$

$= \boxed{.0064}$

Binom opt. 2

Lower R = 6, Upper R = 10

$P(6 \le X \le 10) = \boxed{.0064}$

(c) What is the probability that the student gets the first 4 correct and the last 6 incorrect?

C - correct

$P(C_1 \cap C_2 \cap C_3 \cap C_4 \cap C_5^c \cap C_6^c \cap \cdots \cap C_{10}^c)$

$= (\frac{1}{5})(\frac{1}{5})(\frac{1}{5})(\frac{1}{5})(\frac{4}{5})(\frac{4}{5}) \cdots (\frac{4}{5})$

$= (\frac{1}{5})^4 (\frac{4}{5})^6 = \boxed{.000419}$

(d) How many questions should the student expect to get correct?

$E(X) = np = 10(\frac{1}{5}) = \boxed{2}$

(e) Find the variance and standard deviation for the number of questions answered correctly.

$Var(X) = npq = 10(\frac{1}{5})(1 - \frac{1}{5})$

$\boxed{Var(X) = 1.6}$

$\sigma_X = \sqrt{npq} = \sqrt{1.6} = \boxed{1.2649}$

20. A company manufactures one product. For quality control, a random sample of 6 items is selected from a each lot of products made by this company before the lot is shipped. If any defective items are found in the sample, the entire lot is rejected. If 2.3% of the items produced by this company are defective, what is the probability that a lot will be shipped?

E - the lot is shipped
(i.e. the ~~sample~~ sample has no defectives)

$P(E) = P(\text{no defectives})$

Approximate with binomial probab.

$n = 6$

"success" (what you're looking for) - getting a defective

$p = .023$

Indep - approximately

$P(X=0) = \text{binompdf}(6, .023, 0)$

$= \boxed{.8697}$

n = 6
p = .023
option 1
R = 0

BINUM program

21. A psychological study has determined that 4.8% of all kindergarteners have Attention Deficit Disorder (ADD). In an elementary school with 115 kindergarteners, find the probability that more than 30% have ADD.

$n = 115$

"success" - having ADD

$p = .048$

more than 30% of 115 : $(.3)(115) = 34.5$

more than 34.5 $\rightarrow$ ≥ 35

$P(35 \leq X \leq 115) = 1 - \text{binomcdf}(115, .048, 34)$

$\approx \boxed{0}$

Using the BINOM program:

$n = 115$

$p = .048$

option 2

lower R = 35

upper R = 115

$P(35 \leq X \leq 115) = 6.0662 \times 10^{-19}$

$\approx \boxed{0}$

22. The police department of a certain town estimates that 23% of all drivers in their town do not wear their seatbelts. If 60 cars are stopped at random, what is the probability that more than 90% of the drivers are wearing their seatbelts?

$n = 60$

"success" — wearing seatbelt

$p = 1 - .23 = .77$

Indep. ✓

more than 90% of 60 : $(.9)(60) = 54$

more than 54 means ≥ 55

$P(55 \leq X \leq 60) = 1 - \text{binomcdf}(60, .77, 54)$

$= \boxed{.0028}$

BINOM program:

$n = 60$

$p = .77$

Option 2

Lower R = 55

upper R = 60

$P(55 \leq X \leq 60) = \boxed{.0028}$