Larson – Chapt. 3 & 4

## Math 123: MT 2 Formula Sheet

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Probability  

$$P(E) + P(E') = 1$$

$$P(A \text{ and } B) = P(A). P(B) \quad \text{if independent}$$

$$P(A \text{ and } B) = P(A). P(B|A) \quad \text{if dependent}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) \quad \text{if } A \text{ and } B \text{ are } NOT \text{ mutually exclusive}$$

$$P(A \text{ or } B) = P(A) + P(B) \quad \text{if } A \text{ and } B \text{ are mutually exclusive}$$

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

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

**Discrete Probability Distribution:**  $\mu = \sum x P(x)$ ,  $\sigma^2 = \sum (x - \mu)^2 P(x)$ ,

$$\sigma = \sqrt{\sigma^2} = \sqrt{\sum (x - \mu)^2 P(x)}$$
, Expected Value =  $E(x) = \mu = \sum x P(x)$ 

**Binomial Distribution:**  $P(x) = {}_{n}C_{x} p^{x} q^{n-x}$ ,  $\mu = np$ ,  $\sigma^{2} = npq$ ,  $\sigma = \sqrt{\sigma^{2}} = \sqrt{npq}$ 

**Geometric distribution:**  $P(x) = p q^{x-1}$ 

**Poisson distribution:**  $P(x) = \frac{\mu^{x} e^{-\mu}}{x!}$ , where  $e \approx 2.718$ 

## Math 123, Fall 16, Midterm 2 Instructor: Saba Gerami

Name: Solut

Total: 100 Points

## **Directions:**

- Show all your work.
- You only receive half of the points if you do not explain your reasoning.
- You can use a non-graphing calculator.
- You may not use cell phone, or notes.

1. Determine whether the events are mutually exclusive or not. Explain your reasoning.

(4 points)

a) Event A: Randomly select a red jelly bean from a jar. Event B: Randomly select a yellow jelly from the same jar.

- b) Event A: Randomly select a person who loves cats. Event B: Randomly select a person who loves dogs.
- not mutually exclusive be they can happen at the same time (possible to love cats & dogs)

2. Determine whether the events are independent or dependent. Explain your reasoning.

(4 points)

a) Eating all of your cousin's candies after Halloween and getting a high blood sugar after.

b) Rolling a fair 5-sided die twice and getting a one both times.

3. Perform the indicated calculations without using a calculator. Write down all the steps. 

a) 
$$_{13}P_{6} = \frac{13!}{(13-6)!} = \frac{13!}{7!} = \frac{13!}{7!} = \frac{13 \times 12 \times 11 \times 10 \times 9 \times 8 \times 7!}{7!} = 1,235,520$$
  
b)  $_{6}C_{5} = \frac{6!}{5! \cdot 1!} = \frac{6 \times 5!}{5!} = 6$ 

a) Write an event that has probability of 1. grabbing a yellow ball from a jar full of yellow balls only. b) Write an event that has probability of 0. grabbing a black ball from a jar full of yellow balls only. (4 points) 5. Determine whether the distribution is a probability distribution. Explain. p(x) are between 08 1 (i) all 60 20 30 40 50 X ≥ ≥ p(x)= 0.08+0.13+0.19+0.07+0.05 0.05 P(x) 0.08 0.13 0.19 0.07 = 0.52 ≠ 1 X

(4 points)

=2163

4. anguers may vary.

6. You are given that P(A) = 0.5 and P(B) = 0.27. Do you have enough information to find P(A or B)? Explain your reasoning. (2 points)

7. AHC conducted a survey to determine if students believe that they are ready for adult life. Here are the responses: (4 points)

	Response	Prepared	Somewhat prepared	Slightly prepared	Not prepared	Not sure	
Number of times, $f = 259 = 952 = 552 = 337 = 65 = 6$	Number of times, <i>f</i>	259	952	552	337	63	=2‡

a) Find the probability that a randomly selected student believes he/she is prepared.

$$P(\text{prepared}) = \frac{259}{2163} = 0.12$$

b) Find the probability that a randomly selected student is somewhat or slightly prepared .

 $P(\text{somewhat prep. or slightly prep.}) = \frac{952+552}{1} = Q.70$ mut. exclusive

8. A probability experiment consists of rolling an 8-sided die. Find the probability of the event:

(8 points)

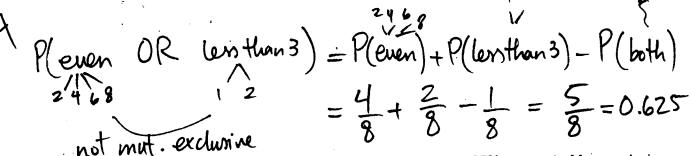
a) Rolling a number less than 6 = 1, 2, 3, 4, 5

$$2 P(x<6) = \frac{5}{8} = 0.625$$

b) Rolling an odd number = 1, 3, 5, 7

$$P(odd) = \frac{4}{8} = \frac{1}{2} = 0.5$$

c) Rolling an even number OR a number less than 3



9. In a jury selection pool, 65% of the people are female. Of these 65%, one out of four works in a health field. However, only 12% of men in the selection pool are in a health field.

(4 points)

a) Find the probability that a randomly selected person from the jury pool is female and works in the health field.

$$\frac{2}{2} 0.65 \ f < \frac{0.25}{0.75} \ \text{not health} \qquad P(\text{female & health}) \stackrel{4}{=} P(\text{f}) \times P(\text{health} | \text{f}) \\ = 0.65 \times 0.25 = 0.1625 \\ = 0.88 \ \text{not health} \\ \text{b) Find the probability that a randomly selected person from the jury pool is male and works in the health field.} \\ 2 P(\text{male & health}) \stackrel{4}{=} P(\text{male}) \times P(\text{health} | \text{male}) \\ = 0.35 \times 0.12 = 0.042 \\ = 0.35 \times 0.12 = 0.042 \\ \end{bmatrix}$$

10. We are picking two cards from a deck of time one by one and replacing it each time before picking the next one. (6 points)

a) Find the probability that we get a king on the first draw AND a queen on the second draw.

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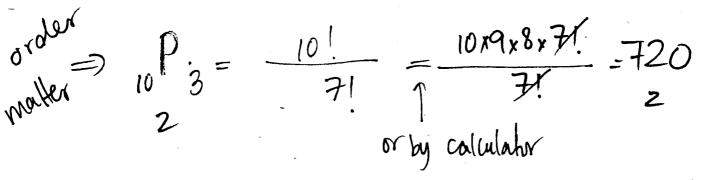
$$P(\text{king And queen}) \stackrel{\text{indep}}{=} P(K) \times P(Q) = \frac{4}{52} \times \frac{4}{52} = 0.005$$
  
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b) Find the probability that we get a king on the first draw OR a queen on the second draw.

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mut. exc  

$$P(king \text{ or } queen) \stackrel{b}{=} P(k) + P(Q) = \frac{4}{52} + \frac{4}{52} = \frac{8}{52} = 0.15$$

11. Ten adults enter an ice-cream-eating race. How many ways can the ice-cream eaters finish first, second, and third? (4 points)



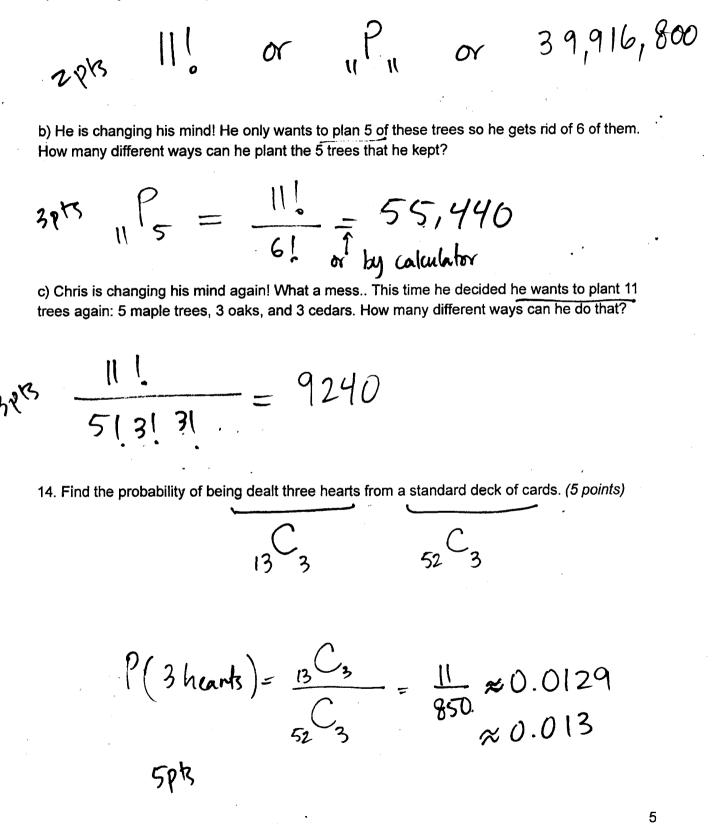
12. AHC wants to send 5 people to the ice-cream-eating contest. Twelve people are interested in going. How many different groups can we send to the contest? (4 points)

 $\frac{|2|}{5! + 7!} = \frac{|2 \times || \times |0 \times 9 \times 8 \times 7!}{| \times 2 \times 3 \times 4 \times 5 \times 7!} = \frac{|2 \times || \times |0 \times 9 \times 8 \times 7!}{0! \times 2 \times 3 \times 4 \times 5 \times 7!}$ order does not matter

13. Chris has 11 trees that he wants to plant in a row.

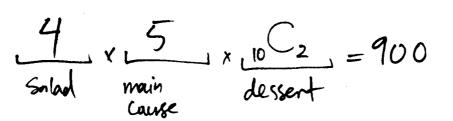
(8 points)

a) How many different ways can he plant all of them if each one is different?



15. You are invited to a fancy wedding where you can choose one of 4 available salad, one of 5 available manin courses, and 2 of 10 available desserts. How many different ways can you eat that night if you wish to have a salad, a main course and two desserts. (5 points)

5pts



16. Find the mean, variance, and standard deviation of the discrete probability distribution <u>using</u> <u>columns as shown in class.</u> (8 points)

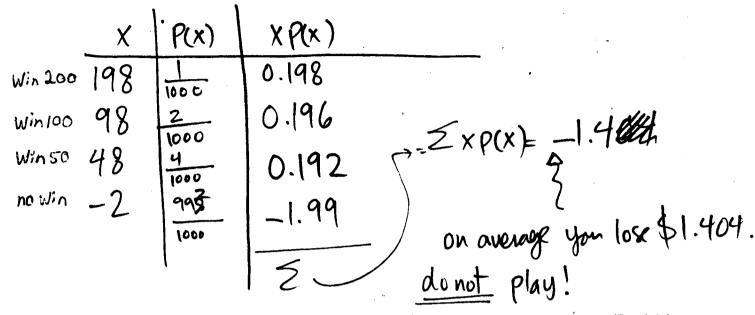
X	0	1	2	3	4
Probability	0.16	0.22	0.28	0.20	0.14

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17. A fundraising lottery sells 1000 tickets at \$2 each. There is one \$200 prize, two \$100 prizes and four \$50 prizes. Let x= your possible winnings if you buy a single ticket. Find the expected winnings, and use this value to <u>explain</u> mathematically why you should or should not play this lottery. (5 points)



18. About 12% of Santa Maria drivers don't wear seat belts.a) Identify *Success*, *Fail*, *p* and *q*.

(5 points)

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-3P = 0.12S = don't wear seat bett  $\rightarrow \gamma = 0.88$ F= wear seat belt سر مرا

b) Find the mean, variance, and standard deviation of the number of Santa Maria drivers who do not wear seat belts if we are randomly picking 100 drivers from Santa Maria.

Binomial mean = hp = 100(0.12) = 12Variance =  $T^2 = npq = (100)(0.12)(0.88) = 10.56$ Std. dev =  $T = \sqrt{T^2} = \sqrt{10.56} = 3.25$ 

$$P(x) = 0.3$$

$$P(x) = 0.7$$

$$P(x) = 0.25$$
(a) Find the probability that the number of adults who say they are trying to eat healthier is exactly 3.  

$$P(x) = \frac{1}{8} \sum_{n=1}^{\infty} (0.3)^{n} (0.7)^{n} = 0.25$$
(b) Find the probability that the number of adults who say they are trying to eat healthier is less than 2.  

$$P(x) = P(x = 0 \text{ or } x = 1) \stackrel{1}{=} P(0) + P(1)$$

$$= \frac{1}{8} \sum_{n=1}^{\infty} (0.3)^{n} (0.7)^{n} = 0.058 + 0.198$$

$$= 0.256$$
20. Twenty-two percent of former smokers say they tried to duil four or more times before they were hail-free. You randomly select 12 former smokers. Find the probability that the first person who tried to quil four or more times is the tried person selected.  

$$P(x = 3) = (0.22)(0.78)^{3.1} = (0.22)(0.78)^{2} = 0.133$$
21. During a 12-year period, sharks killed an average of 5 people each year workdy. Find the probability that the number of people killed by sharks next year is exactly 4.  

$$P(x = 4) = \frac{5}{4} \cdot \frac{(2.718)^{-5}}{41} = 0.176$$

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