Math 11 Winter 2019 Exam 4 Name Last KEY First _____

83 points out of 80 are possible on this exam.

PUT AWAY AND TURN OFF ALL CELL PHONES.
You are not permitted to use your cellphone for any reason during the exam.

You must hand in your page of notes with the exam.
Write your name on the notes and insert it inside the exam paper. You will get it back with your graded exam.

Due to math notation formatting issues:
- **the word AND is used to mean intersection ∩**
- **the word OR is used to mean union U.**

You can use the words AND, OR - or you can use ∩ and U symbols, your choice.

The 6 multiple choice questions do not have partial credit.
All other questions can have partial credit if sufficient correct work is shown.

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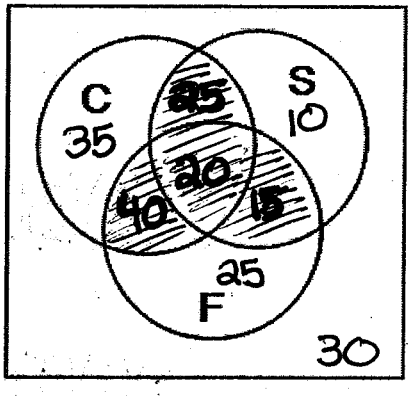
1. [8 *points*] In a market research study, 200 people were asked what types of restaurants they have eaten in within the past month.

120 ate at casual dining restaurants (C)
100 ate at fast food restaurants (F)
70 ate at full service restaurants, with waiter table service (S)
Of those: 60 ate at both casual dining (C) and fast food (F) restaurants
45 ate at both casual dining (C) and full service (S) restaurants
35 ate at both fast food (F) and full service (S) restaurants
This includes 20 who ate at all of these types of restaurants.



Also some people did not eat at any of these three types of restaurants.

Let sets C = {people who ate at a casual dining restaurant}
F = {people who ate at a fast food restaurant}
S = {people who ate at a full service restaurant}

a. Fill in the numbers all 8 regions on the Venn Diagram (*both inside and outside the circles*)

b. Find the number of people who ate at "at least two" of these types of restaurants.

$25+40+15+20=100$ (shaded areas in graph)

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2. [3 *points*] A school has 7 substitute teachers in its substitute pool and needs 3 substitute teachers today. **How many different selections (choices)** of 3 of the 7 substitute teachers are possible?

A. 210 B. 840 C. 21 D. 35 E. 343 F. 5040

$_7C_3$

ANSWER: D

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3. [4 *points*] How many different 6 character license plates are possible if a license plate must have 3 letters with no letter used more than once, followed by 3 digits, repeated digits permitted.
(There are 26 letters in English alphabet and 10 digits 0-9.)

$(26)(25)(24)(10)(10)(10) = 15{,}600{,}000$

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4. [3 *points*] A jewelry store displays necklaces on a rotating display case. If 8 necklaces are displayed in in this rotating case, how many different circular arrangements are possible?

$\frac{8!}{8}$ or $(8-1)! = 7! = 5040$

5. The word **UNIVERSAL** has 9 letters: 4 vowels are AEIU 5 consonants are NSVRL
In all parts of this question below, a letter can be used only once – it can not be repeated.

a. [3 *points*] How many ways can we arrange all 9 letters of the word UNIVERSAL?

A. 15120 B. 35 C. 362,880 D. 387,420,489 E. 840 **ANSWER:** C

$_9P_9$ or $9!$

b. [3 *points*] How many ways can we arrange 5 out of the 9 letters from the word UNIVERSAL?

A. 15120 B. 120 C. 362,880 D. 3024 E. 126 **ANSWER:** A

$_9P_5$

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6. [4 *points*] **How many <u>different</u> arrangements** are possible using all 12 letters of the word **TEETERTOTTER**? *Show work*

O: 1
T: 5
E: 4
R: 2

$\frac{12!}{5!4!2!}$ or $\frac{12!}{5!4!2!1!} = 83160$

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7. A car dealership has 6 office staffers, 5 salespeople, and 7 mechanics. A team of 8 people is to be chosen.
Show work. For questions requesting probabilities, round answer to 3 decimal places.

a. [4 *points*] **How many different team selections** of 8 people are possible if the team must consist of 3 office staffers, 2 salespeople and 3 mechanics

$\binom{6}{3}\binom{5}{2}\binom{7}{3} = ({}_6C_3)({}_5C_2)({}_7C_3) = (20)(10)(35) = 7000$

b. [4 *points*] Find the **<u>probability</u>** that an 8 person team consists of 3 office staffers, 2 salespeople and 3 mechanics.

$\frac{\binom{6}{3}\binom{5}{2}\binom{7}{3}}{\binom{18}{8}} = \frac{7000}{43758}$ $\frac{({}_6C_3)({}_5C_2)({}_7C_3)}{({}_{18}C_8)} = \frac{7000}{43758} = .16$ .15997

c. [4 *points*] Find the **<u>probability</u>** that a randomly selected team of 8 people has 4 or 5 mechanics.

$\frac{\binom{7}{4}\binom{11}{4} + \binom{7}{5}\binom{11}{3}}{\binom{18}{8}} = \frac{({}_7C_4)({}_{11}C_4) + ({}_7C_5)({}_{11}C_3)}{{}_{18}C_8} = \frac{(35)(330) + (21)(165)}{43758}$

$= \frac{15015}{43758} = .343$

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8. [4 *points*] At Express Used Auto Sales Co, the profit earned or loss incurred on a used car depends on how long it takes to sell the car. **X = profit earned or loss incurred from the sale of one car**

20% of cars sell in within two weeks, earning a profit of $900.
25% of cars sell in the third week, earning a profit of $600.
40% of cars sell in the fourth week, earning a profit of only $200
15% of cars sell take longer than four weeks to sell, incurring a <u>loss</u> of $400.

Find the expected value for the net profit or loss from the sale of one car.
Show work; round to the nearest dollar.

$E = .2(900) + .25(600) + .4(200) + .15(-400) =$ $350 expected profit per car on average

9. [12 *points total*] BookWorld sells books in their retail bookstores and online on their website.

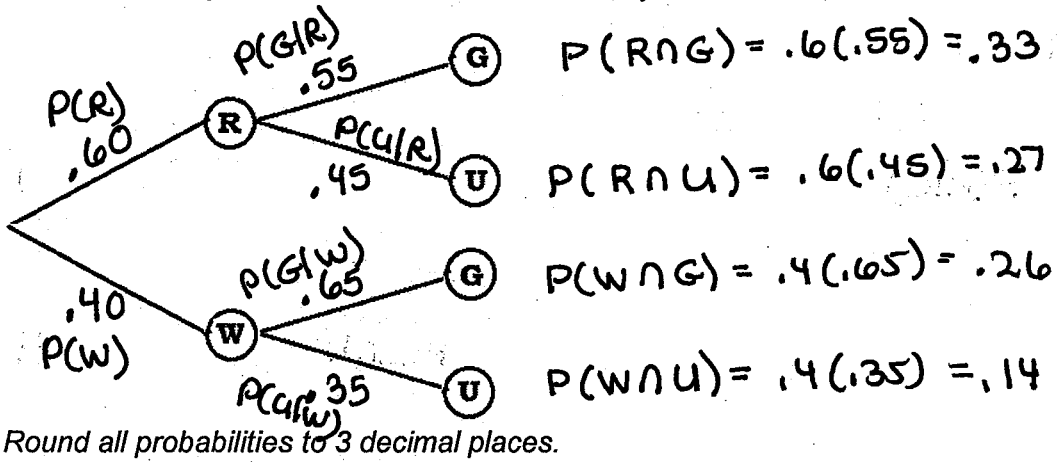
60% of books are purchased in their retail stores (R) and the rest are online sales on their website (W)

55% of books purchased in the retail stores are bought by the buyer as a gift (G)
and the rest are purchased for the buyer's personal use (U)

65% of the books sold online on their website are bought by the buyer as a gift (G)
and the rest are purchased for the buyer's personal use (U)

Events: R = book is purchased in retail store U = book is purchased by buyer for personal use
W = book is purchased on website G= book is purchased as gift

Use the tree as needed to help you answer the questions below.
You are graded on your answers to the questions, but not on the information you write on the tree.
Be careful to put the numbers in the correct places on tree. Read events & letters carefully!



$P(R \cap G) = .6(.55) = .33$

$P(R \cap U) = .6(.45) = .27$

$P(W \cap G) = .4(.65) = .26$

$P(W \cap U) = .4(.35) = .14$

Round all probabilities to 3 decimal places.

a. [3 *points*] Find the probability that a book is purchased at the **website <u>and</u> is a gift.**

$P(W \cap G) = P(G|W)P(W) = (.65)(.4) = .26$

b. [3 *points*] Find the probability that a book is purchased **as a gift.**

$P(G) = P(W \cap G) + P(R \cap G) = .26 + .33 = .59$

c. [3 *points*]
Find the probability that a book is purchased at the **website, <u>if (given that)</u> the book is a gift.**

$$P(W|G) = \frac{P(W \cap G)}{P(G)} = \frac{.26}{.59} = .441$$

d. [3 *points*]
Find the probability that a book is purchased for the **buyer's personal use (U), <u>if (given that)</u> the book is purchased in the retail store (R).**

$P(U|R) = 1 - P(G|R) = 1 - .55 = .45$

10. [9 *points*] A random sample of 430 high school students at 3 different high schools were surveyed about their college plans. The results of the survey are summarized in the table.

	High School			
Educational Goal	Hilltop High (H)	Valley High (V)	River High (R)	Total
Attend Private College (A)	36	80	49	165
Attend Public 4 Year College (B)	18	60	51	129
Attend Community College (C)	16	32	38	86
Other Plans (D)	10	28	12	50
Total	80	200	150	430

Suppose that one student from the sample is randomly selected circled values are for part (C)

a. Find the probability that a student is at River High (R) if (given that) the student plans to attend community college (C).

A. 38/150 B. 38/86 C. 236/430 D. 198/430 E. 38/430 F. 86/150

P(C|R) P(R|C)

ANSWER: B

b. Find the probability that a student attends River High (R) and plans to attend community college (C).

A. 38/150 B. 38/86 C. 236/430 D. 198/430 E. 38/430. F. 86/150

P(C∩R)

ANSWER: E

c. Are events C, H independent?
Show your work comparing appropriate probabilities and state your conclusion.
You must show numerical correct work using appropriate probabilities to get credit on this problem.
No Correct Work = No Credit, even if the conclusion is correct.

$P(C|H) = \frac{16}{80} = .2$ $P(C) = \frac{86}{430} = .2$

$P(C|H) = P(C)$

Yes
Independent

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11. A financial survey asks people about the types of investments they have.
Of the people in the survey:
76% have bank certificates of deposit $P(C) = .76$
60% have stocks $P(S) = .60$
20% have bonds
52% have both stocks and bank certificates of deposit $P(C \cap S) = .52$

Events: S = stock C = bank certificates of deposit B = bonds

a. [3 *points*] Find P(C|S).

$P(C|S) = \frac{P(C \cap S)}{P(S)} = \frac{.52}{.60}$

A. 0.867 B. 0.864 C. 1.267 D. 0.789 E. 0.84 F. 0.456 G. 1.36

ANSWER: A

b. [4 *points*] Find P(C **or** S). *Show work. State answers rounded to 3 decimal places.*

$P(C \text{ OR } S) = P(C \cup S) = P(C) + P(S) - P(C \cap S)$

$= .76 + .60 - .52$

$= .84$

12. [4 *points*] Creative Advertising Agency finds that:
30% of all clients use magazine advertising (M)
60% of all clients use internet advertising (I)
75% of all clients use TV and Radio advertising (T)
Of those clients who buy internet advertising, 30% also buy magazine advertising $P(M|I) = .30$

Find P(I ∩ M), the probability that a client uses both magazine and internet advertising.
Show work. State answers rounded to 3 decimal places.

$P(I \cap M) = P(M|I)\,P(I) = .30(.60) = .180$

Note you can NOT do $P(I|M)\,P(M)$ because we don't know the value of $P(I|M)$

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13. [3 *points*] At Sports Supply Shop, 72% of customers buy sports equipment (Event E) and 57% of customers by sports apparel (clothing) (Event A).
A market analysis of purchases shows that these two events are independent.
Show work. State answers rounded to 2 decimal places.

Find $P(E \mid A) = P(E) = .72$ because $P(E|A) = P(E)$ if E, A are independent

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14. [4 *points*] 43% of De Anza College students are full-time students.
A group of 9 students is randomly selected.
We are interested in the number of students in this group who are full time students.

For students in the group, whether any student is full-time is independent of the other students in the group.

Find the probability that 5 of the students in the group of 9 students are full time students.

Show work in how to do the calculation using the appropriate formula and evaluate the answer.
State answers rounded to 3 decimal place.

$P(X=5) = (_9C_5)(.43^5)(.57^4) = .196$

binomial probability (section 9.1)