İDepartment of Mathematics
University of Notre Dame
Math 10120 – Finite Math
Spring 2018

Name:_____

Instructors: Basit/Galvin

Exam 1

February 8, 2018.

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Record your answers to the multiple choice problems on this page. Place an × through your answer to each problem.

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May the odds be ever in your favor!

1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)
6.	(a)	(b)	(c)	(d)	(e)
7.	(a)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)

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Multiple Choice

1. (5 pts.) Let $U = \{a, b, c, d, e, f, g, h\}$ be the universal set. If $A = \{a, c, d, f, h\}$, $B = \{a, b, c, d, e\}$ and $C = \{d, e, f, g, h\}$. What is $(B \cap C)^c \cap A$?

(a) $\{d\}$

(b) $\{a, b, c, d, f, g, h\}$

(c) $\{a, c, d, f, h\}$

(d) $\{a, c, f, h\}$

(e) $\emptyset$

2. (5 pts.) The access code to my phone is a string of AT LEAST 5 symbols, without repetition, from the set of symbols $\{0, 1, 2, 3, 4, 5, 6\}$. The total number of possible access codes is

(a) $P(7, 5)$

(b) $C(7, 5)$

(c) $P(7, 5) \cdot P(7, 6) \cdot P(7, 7)$

(d) $P(7, 5) + P(7, 6) + P(7, 7)$

(e) $C(7, 5) + C(7, 6) + C(7, 7)$

3. (5 pts.) A group of 30 students who exercise regularly, were asked about their exercise preferences. 15 students said they swam, 20 students said they ran, and 5 students said they neither swam nor ran. How many students said they did both types of exercise?

(a)   10   (b)   20   (c)   5   (d)   15   (e)   25

4. (5 pts.) A sandwich shop offers a lunchtime special: make a sandwich using one of 4 choices of bread, one of 3 choices of meat, one of 3 choices of cheese, and two of 5 types of vegetable. How many different sandwiches are possible? (You can't skip any options; for example, you must choose *exactly* two vegetables).

(a)   20   (b)   360   (c)   90

(d)   720   (e)   180

5. (5 pts.) A student council committee has 7 reps from Carroll Hall, 6 reps from Badin Hall and 10 from Pasquerilla Hall. In how many ways can a sub-committee of 3 people be formed, if all three must be from the same hall?

(a) $C(23,3)3!$

(b) $C(7,3)C(6,3)C(10,3)$

(c) $P(7,3)+P(6,3)+P(10,3)$

(d) $P(7,3)P(6,3)P(10,3)$

(e) $C(7,3)+C(6,3)+C(10,3)$

6. (5 pts.) When I toss a coin, it either comes up heads or tails. In how many ways can I toss a coin 7 times in a row, getting *at least one* head?

(a) 8

(b) 127

(c) 120

(d) 5039

(e) 7

7. (5 pts.) Recall that there are 52 cards in a standard deck, 13 from each suit (clubs, diamonds, hearts and spades). A Poker hand consists of 5 cards. How many Poker hands have three 2's and two face cards? (The face cards in each suit are the J, Q and K.)

(a) $C(4,3) \cdot C(12,2)$ (b) $P(4,3) \cdot P(12,2)$

(c) $P(4,3) + P(12,2)$ (d) $C(4,3) + C(12,2)$

(e) $C(4,3) \cdot C(49,2)$

8. (5 pts.) In a chess tournament with 12 participants, every player plays a game with every other player. How many games are played in total?

(a) 144   (b) 145

(c) 66   (d) 132

(e) 24

9. (5 pts.) How many five letter words (including nonsense words) can be formed using the usual english alphabet, that contain exactly two vowels? (Vowels are a, e, i, o and u; repetitions of letters are allowed.)

(a) $5^2 \cdot 21^3$

(b) $P(26, 2) \cdot 5^2$

(c) $C(5, 2) \cdot 26^5$

(d) $P(26, 5)$

(e) $C(5, 2) \cdot 5^2 \cdot 21^3$

10. (5 pts.) A class has 11 students. The instructor has in mind three projects: a math project, a biology project and a philosophy project. She plans to divide the class into three groups: one with 4 people, to do the history project; another with 4 different people, to do the math project; and the last with the remaining 3 people, to do the biology project. In how many ways can she divide the class into these groups?

(a) $C(11, 4) \cdot C(11, 4) \cdot C(11, 3)$

(b) $C(11, 4) \cdot C(7, 4) \cdot C(3, 3)$

(c) $C(11, 4) + C(7, 4) + C(3, 3)$

(d) $P(11, 4) \cdot P(7, 4) \cdot P(3, 3)$

(e) $C(11, 4) + C(11, 4) + C(11, 3)$

Partial Credit

You must show **all of your work** on the partial credit problems to receive full credit! Make sure that your answer is **clearly** indicated. You're more likely to get partial credit for a wrong answer if you explain your reasoning.

11. (12 pts.) A family has 9 chihuahuas and 4 dalmatians (yikes!). Answer the following questions; if your answer involves a $C(n,r)$ or $P(n,r)$ or $r!$, you must calculate the actual value numerically for full credit.

(a) In how many ways can the 13 dogs be fed in the evening, one after the other, if all the dalmatians have to be fed before all the chihuahuas?

(b) In how many ways can the family pick either 3 chihuahuas or 3 dalmatians to take on a walk?

(c) 3 dogs are allowed on the bed each night; at least 2 of them must be chihuahuas. How many different ways can these 3 lucky dogs be selected?

12. (13 pts.) The following three yes/no questions were posed to a class of 68 students in a survey:

- (i) Do You like rap music?
- (ii) Do You like classical music?
- (iii) Do You like 80's music?

The results showed that

- 44 liked rap music, 47 liked classical music and 55 liked 80's music,
- 19 students liked all three types of music, and
- 26 liked rap and classical, 38 liked classical and 80's, and 34 liked rap and 80's.

(a) Present the data given above on a Venn diagram, where R denotes the set of students who like rap, C denotes the set of students who like classical and E denotes the set of students who like 80's music.
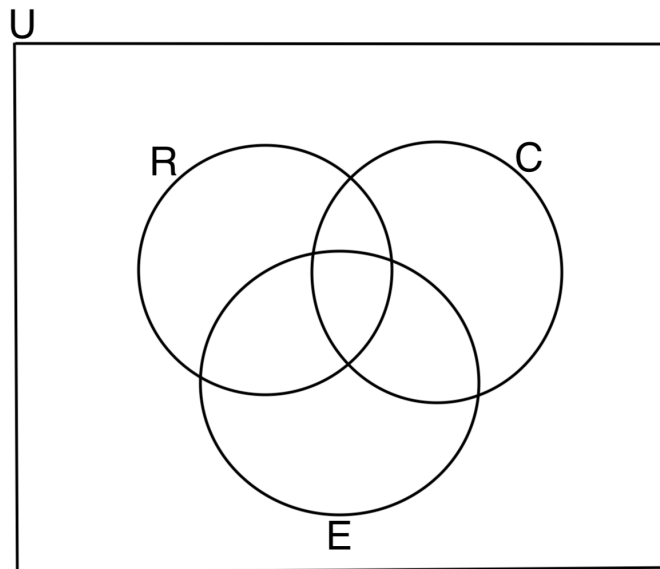
(b) How many students don't like any of the above music types?

(c) How many students like at least two of the three types of music?

(d) If a student is in the set $E \cap (R \cup C)^c$, what answers did they give to questions (i), (ii) and (iii)?

- Answer given to (i):
- Answer given to (ii):
- Answer given to (iii):

13. (13 pts.) Patty's Pizza has a build your own pizza option, where you can choose any combination of toppings. You can pick any number of cheeses, from among 3 options, and any number of toppings, from among 7 options.

Note: In the following three parts, it is not necessary to give a numerical answer, i.e. you may express your answers using the notation for permutations ($P(n,k)$), combinations ($C(n,k)$), factorials ($n!$) and powers (a^k).

(a) How many different pizzas can you build, if you are not allowed to build an "empty" pizza (meaning, you can't build a pizza that has no cheese and no toppings)? Note that you are allowed, for example, to have no cheese and 3 toppings, or 2 cheeses and no toppings.

(b) The 2-4 deal lets you build a pizza with exactly 2 types of cheese and any 4 toppings (no more, no less). How many such pizzas can be made?

(c) How many pizzas can be made with just mozzarella cheese and between 1 and 4 (inclusive) toppings?

14. (12 pts.) The grid below represents a map of Gotham with certain locations marked at points A, B, C and D.
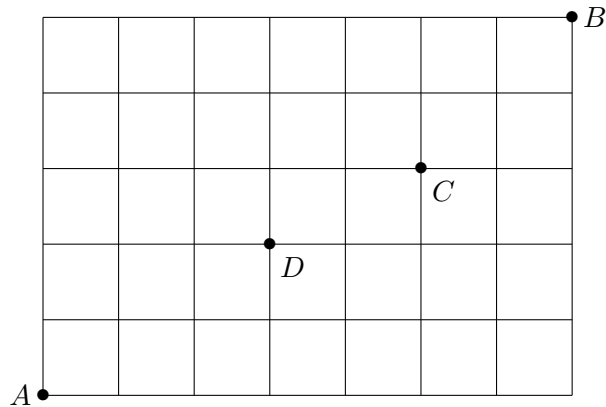
Suppose you want to travel from point A to B, going only UP and RIGHT. For each of the following, work out **a numerical answer**.

(a) How many paths are there from A to B?

(b) How many paths are there from A to B going through C?

(c) How many paths are there from A to B going through C or D (or both)?

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1. (a) (b) (c) (**d**) (e)

2. (a) (b) (c) (**d**) (e)

3. (**a**) (b) (c) (d) (e)

4. (a) (**b**) (c) (d) (e)

5. (a) (b) (c) (d) (**e**)

6. (a) (**b**) (c) (d) (e)

7. (**a**) (b) (c) (d) (e)

8. (a) (b) (**c**) (d) (e)

9. (a) (b) (c) (d) (**e**)

10. (a) (**b**) (c) (d) (e)

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