Department of Mathematics
University of Notre Dame
Math 10120 – Finite Math.
Spring 2017

Name:_____

Instructors: Conant/Galvin

Exam 1 — practice exam

February 9, 2017

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May the odds be ever in your favor!

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Multiple Choice

1. (5 pts.) Let $\mathcal{U}$ be the universal set

$$\mathcal{U} = \{0, 1, 2, 3, 4, 5, 6\}.$$

If $A = \{1, 2, 3\}$, $B = \{3, 4\}$ and $C = \{2, 4, 5\}$, then $(A \cup B) \cap C' =$

(a) $\{2, 4\}$ (b) $\{1, 2, 3, 4\}$ (c) $\{1, 3\}$

(d) $\{3\}$ (e) $\{5\}$

2. (5 pts.) A code consists of AT LEAST 4 symbols without repetition from the set of symbols

$$\mathcal{S} = \{\$, \circ, \#, \&, !, \%\}.$$

The total number of codes possible is

(a) $\mathbf{C}(6, 4) + \mathbf{C}(6, 5) + \mathbf{C}(6, 6)$ (b) $\mathbf{P}(6, 4)$

(c) $\mathbf{C}(6, 4)$ (d) $\mathbf{P}(6, 4) + \mathbf{P}(6, 5) + \mathbf{P}(6, 6)$

(e) $\mathbf{P}(6, 4) \cdot \mathbf{P}(6, 5) \cdot \mathbf{P}(6, 6)$

3. (5 pts.) At Tubway Sandwich shop there are 4 kinds of bread, 3 kinds of meat, 3 kinds of cheese and 5 kinds of vegetable. You can make your own sandwich by choosing 1 bread, 1 type of meat, 1 kind of cheese and 2 kinds of vegetable. How many different sandwiches are possible?

(a) 360 (b) 180 (c) 20

(d) 90 (e) 720

4. (5 pts.) How many 3 digit numbers greater than 200 can be made from the set of numbers

$$\{1, 2, 3, 7, 8\},$$

where numbers are NOT allowed to repeat?

(a) 48 (b) 100 (c) 11

(d) 36 (e) 125

5. (5 pts.) Compute $\mathbf{C}(10, 6) \cdot 4!$

(a) 120,960 (b) 3,628,800 (c) 5,040

(d) 840 (e) 604,800

6. (5 pts.) A committee of 3 people needs to be chosen from among 4 men and 5 women. How many different committees can be formed that include exactly 1 women?

(a) 60 (b) 12 (c) 30

(d) 80 (e) 100

7. (5 pts.) In the cellar of the Snite museum there are seven recently discovered Monet paintings, six Van Goghs, and ten Picassos. In how many ways can the museum curator choose a set of three paintings to display upstairs, if all three should be by the same artist?

(a) $\mathbf{C}(23,3) \cdot 3!$

(b) $\mathbf{P}(7,3) + \mathbf{P}(6,3) + \mathbf{P}(10,3)$

(c) $\mathbf{C}(7,3) \cdot \mathbf{C}(6,3) \cdot \mathbf{C}(10,3)$

(d) $\mathbf{P}(7,3) \cdot \mathbf{P}(6,3) \cdot \mathbf{P}(10,3)$

(e) $\mathbf{C}(7,3) + \mathbf{C}(6,3) + \mathbf{C}(10,3)$

8. (5 pts.) There are 15 American League baseball teams and 15 National League teams. During a month of inter-league play, each team from one league should play all the teams from the other league exactly twice. How many inter-league games are played in all?

(a) 435

(b) 120

(c) 60

(d) 450

(e) 225

9. (5 pts.) I have a combinatorics class with twelve students. I have four different final projects in mind for the class, and I want to split the class into four groups, each of size three, one group to do the first project, one to do the second, one to do the third, and one to do the fourth. I also want to select a group leader for each group. In how many ways can I do all this?

(a) $\frac{12!}{3!3!3!3!}$ (b) $\binom{12}{3,3,3,3}/4!$ (c) $\binom{12}{3,3,3,3} \cdot 4!$

(d) $4\frac{12!}{3!3!3!3!}$ (e) $\binom{12}{3,3,3,3} \cdot 3^4$

10. (5 pts.) 24 couples go to a dance (so 48 people in total). At some point the DJ wants to choose 6 people to help him plan the next few tracks on his playlist, but he doesn't want any two people who are a couple to be among the six. In how many different ways can he choose the six people?

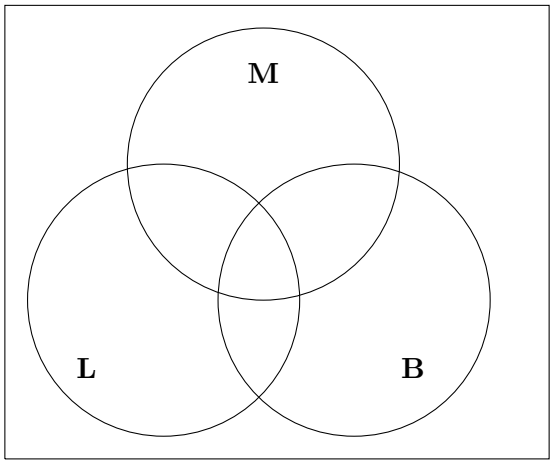
(a) $\mathbf{C}(48,6) - 2^6$ (b) $\mathbf{C}(24,6) \cdot 2^6$ (c) $\mathbf{C}(24,6) \cdot 2^{24}$

(d) $\mathbf{C}(24,6) \cdot 6^2$ (e) $\mathbf{C}(48,6)/24$

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. (10 pts.) In a survey where 100 students reported which subjects they like, 32 students in total liked Mathematics, 38 students liked Business and 30 students liked Literature. Moreover, 10 students liked both Mathematics and Business, 8 students liked both Business and Literature, and 7 students liked both Mathematics and Literature. 5 students liked all three subjects.



(a) Find the number of people who liked exactly 1 subject.

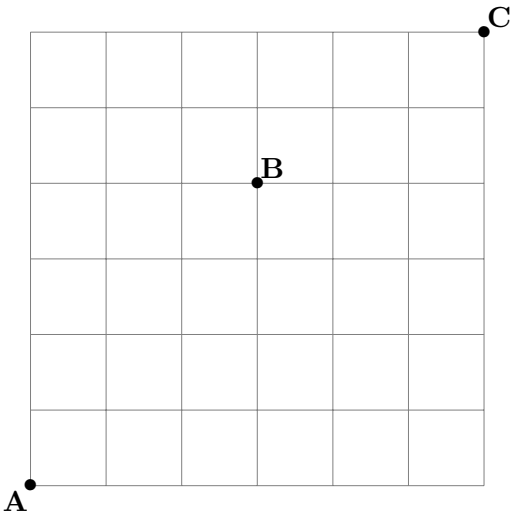
(b) How many students did not like any of the subjects?

12. (10 pts.) Bob, John, Andrew, Jessica and Valentina wants to take a photo of themselves where they stand side-by-side.

(a) How many different photos are possible?

(b) Jessica and Valentina are BFFs, and they want to stand next to each other in the photo. How many different photos are possible with Jessica and Valentina standing next to each other?

13. (10 pts.) For the following problem you do not need to simply your answers, i.e. you may express your answers using the symbols for permutations ($\mathbf{P}(n, r)$), combinations ($\mathbf{C}(n, r)$) or factorials ($n!$). The following is part of the city map of Gridville, Iowa.



(a) If one only travels east (i.e. to the right) or north (i.e. up), how many paths are there from **A** to **C**?

(b) How many paths from **A** to **C** (again only traveling east or north) **do not** go through **B**?

14. (10 pts.) I have an ordinary coin, that comes up either Heads or Tails each time I toss it. I plan to toss it 5 times in a row, and record the sequence of heads and tails that I get.

(a) How many possible sequences are there?

(b) In how many of those sequences counted in part (a) are the last three tosses all Heads?

(c) In how many of those sequences counted in part (a) are EITHER the first three tosses all Heads OR the last three tosses all Heads?

15. (10 pts.) 12 teams enter a volleyball tournament. In the first round, the teams are broken up into six pairs to play each other.

(a) In how many different ways can this be done? (Neither the order of the six pairs nor the order of teams within each pair, matters.) For this part, calculate out your answer as a number.

(b) Assume that within each pair, one team is designated the home team and the other is designated the away team (this is, the order within each pair matters), and also the six first round matches are to be run one after another. In how many different ways can this be done, now that **both** the order of the teams within each pair, **and** the order of the six pairs, matters? Ffor this part, an answer involving permutation, combination, partition and/or factorial symbols is fine.

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