

Name: \_\_\_\_\_

Problem	Total
Possible	100
Received	

**DO NOT OPEN YOUR EXAM UNTIL TOLD TO DO SO.**

**You may use a  $3 \times 5$  (both sides) of handwritten notes.**

**You will not use a calculator for this exam.**

**In answering the following questions, except on page 4, do not simplify the answers. For example, leave your answer in the form  $P(5, 3)$  or  $12!$  or  $C(4, 3) \cdot C(7, 4)$  or  $2^5 - 2^3$  or  $7 \cdot 6 \cdot 5$  or ...**

**CLOSE TO HOME** By John McPherson



**Before giving out candy, the Gernsteads required that trick-or-treaters first watch a short video on dental care.**



Deer Halloween

- /3 In how many ways can I arrange 6 French books and 8 novels on a shelf if the novels all have to be next to each other?
- /3 In how many ways can I select 3 books from 8?
- /3 In how many ways can I arrange 3 books of 8 on a shelf?
- /3 How many social security numbers are there if the only number that cannot be assigned is 000-00-0000?
- /3 In how many ways can I divide a group of 20 people into two groups of 5 and one group of 10?
- /3 How many ways can you give a \$1, \$2, and a \$5 bill to 3 of your 8 friends (one bill for each friend that you choose)?
- /3 In how many ways can you choose 3 green balls and 2 red ones from a basket containing 5 green, 4 red and 6 yellow balls?
- /3 How many numbers between 100000 and 999999 are there in which three digits are one number and the other three digits are another (e.g. 525252, 225552, 555222, etc.)?
- /3 A certain country has 10-digit phone numbers: 3-digit area code, 7-digit phone number. How many 10-digit phone numbers are there if the only restriction is that 0 cannot be the first digit of either the area code or of the phone number?

- /3 In how many ways could we divide a basketball team of 15 players into the 5 starters and the 10 substitutes?
  
- /3 How many 4-digit numbers from 1000 to 9999 are there in which the digits are all different?
  
- /3 How many ways could I choose three different toppings to put on three scoops of ice cream: one scoop of vanilla and two scoops of chocolate.
  
- /3 If I have 10 pieces of candy, all of different types, and 10 kids show up at my door, in how many different ways could I hand the candy out, one piece to each kid?

*For the next four questions, there are 5 couples: 1 boy and 1 girl per couple; so in all, 5 boys and 5 girls, and 10 persons total.*

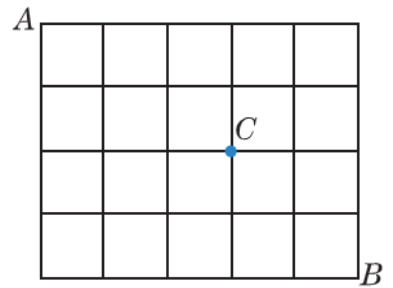
- /3 In how many ways can we select 7 persons consisting of 3 boys and 4 girls?
  
- /3 In how many ways can we select 4 persons if all 4 must come from different couples, i.e. you cannot have a boy and girl from the same couple?
  
- /3 In how many ways can the 10 persons be seated side-by-side if the boys must be seated next to each other and the girls must to be seated next to each other?
  
- /3 In how many ways can the 10 persons be seated side-by-side if each couple must be seated together?

For problems on this page, simplify your answers, i.e., compute an actual number.

*For the next five questions, there are 5 boys and 5 girls, so 10 persons total.*

- /5 In how many different ways could we choose 1 boy and 1 girl?
  
  
  
  
  
  
  
  
  
  
- /5 In how many different ways could we choose any 2 of the 10?
  
  
  
  
  
  
  
  
  
  
- /5 In how many different ways could we divide the 10 into two groups of sizes 2 and 8?
  
  
  
  
  
  
  
  
  
  
- /5 In how many different ways could we choose a president and a vice-president from these 10 kids?
  
  
  
  
  
  
  
  
  
  
- /5 If the girls are named Alice, Barb, Carol, Deb, and Elizabeth, in how many different ways could we seat the 10 kids side-by-side if the girls must all be next to each other and in alphabetical order?

For the above problems, simplify your answers, i.e., give an actual number.



*For the next two questions, you will go from point A to point B, and you will either go right (East) or down (South).*

/3 How many shortest routes are there from A to B?

/3 How many shortest routes are there from A to B that pass through C?

*For the next two questions, 20 runners will run a race. We are interested in how all 20 runners finish (rather than just the top 3, for example).*

/3 How many different outcomes are there, i.e. how many different orderings are there of how the 20 runners finish the race?

/3 One of the runners is named Bob. How many different outcomes are there in which Bob finishes first?

*For the next three questions, suppose there is a deck of 60 cards of 4 different colors of cards numbered 1 to 15. In how many ways can you choose 8 cards so that:*

/4 You have a pair: 2 of one number, and the other 6 cards are all different other numbers, for example, 5 5 1 3 4 7 9 15.

/4 All of them are the same color, for example, 1 3 4 5 7 9 11 15, all of one color.

/4 You have a really full house: 3 of one number, 3 of another number, and 2 of another number, for example, 5 5 5 7 7 11 11 11.