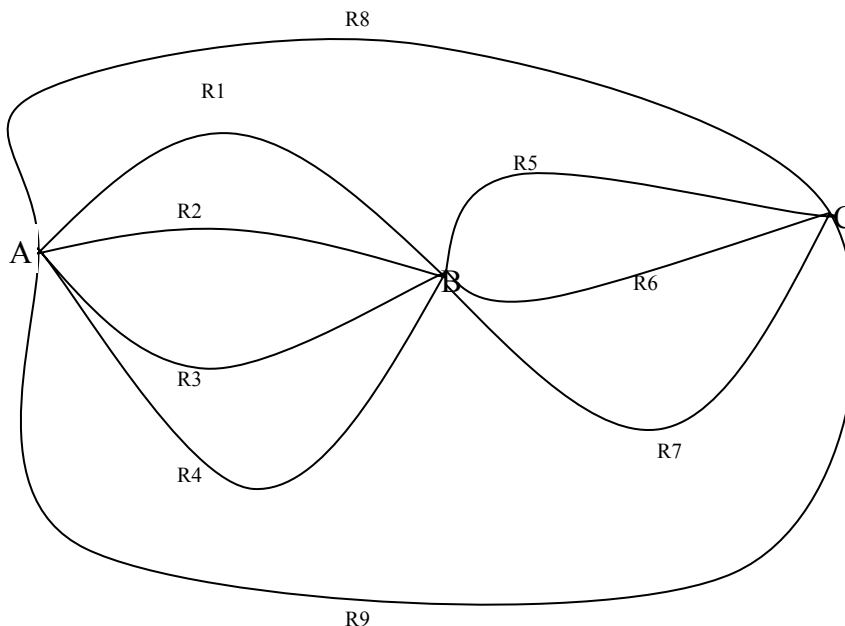


HW4 Permutations and Combinations
(Due at the beginning of class on Monday March 5)

Use your own paper, type your answer, and show work as much as possible.

Permutations

1. (5 points) A certain “Burger Joint” advertises that a customer can have his or her hamburger with or without any or all of the following: catsup, mustard, mayonnaise, lettuce, tomato, onion, pickle, cheese, or mushrooms. How many different kinds of hamburger orders are possible?
2. Three small towns, designated by A, B, and C, are inter-connected by a system of two-way roads, as shown in the following figure.



- a. (5 points) In how many ways can Linda travel from town A to town C?
 - b. (5 points) How many different round trips can Linda travel from town A to town C and back to town A?
 - c. (5 points) How many of the round trips in part (b) are such that the return trip (from town C to town A) is at least partially different from the route Linda takes from town A to town C? (For example, if Linda travels from town A to town C along roads R₁ and R₆, then on her return she might take roads R₆ and R₃, or roads R₇ and R₂, or road R₉, among other possibilities, but she does not travel on roads R₆ and R₁.)
3. Over the Internet, data are transmitted in structured blocks of bits called *datagrams*.
 - a. (10 points) In how many ways can the letters in DATAGRAM be arranged?
 - b. (10 points) For the arrangements of part (a), how many have all three A's together?

4. (10 points) Show that for all integers $n, r \geq 0$, if $n+1 > r$, then

$$P(n+1, r) = \left(\frac{n+1}{n+1-r} \right) P(n, r)$$

5. Consider the following program segment where i, j , and k are integer variables.

```
for  $i$ : = 1 to 12 do  
  for  $j$ : =5 to 10 do  
    for  $k$ : = 15 downto 8 do  
      Print  $(i - j)*k$ 
```

- a. (10 points) How many times is the **print** statement executed?
b. (10 points) Which counting principle is used in part (a)?

Combinations

6. (5 points) a. How many permutations of size 3 can one produce with the letters m, r, a, f and t?
(5 points) b. List all the combinations of size 3 that result for the letters m, r, a, f and t.
7. How many bytes contain
- (2.5 points) exactly two 1's?
 - (2.5 points) exactly four 1's?
 - (2.5 points) exactly six 1's?
 - (2.5 points) at least six 1's?
8. (10 points) How many arrangements of the letters in MISSISSIPPI have no consecutive S's?