NAME: _____ **Math2701-001**

Exam 3: Sections $3.1 - 3.4, 4.3 - 4.4, 6.1 - 6.2$ (5^{th} ed.); $[3.1], 2.4, 4.1, 4.3, 5.3 - 5.4, 7.1 - 7.2$ (6^{th} ed.) Discrete Structures

Please show all work. When some work is required, **NO WORK = NO CREDIT.**

1. (17 points) Find the value of each of the following sums:
   (a) $\sum_{j=0}^{7}(2^{j+1} - 2^j)$

   (b) $\sum_{i=0}^{3}\sum_{j=0}^{2}(2i + 3j)$

   (c) $1 + \frac{1}{2} + \frac{1}{2^2} + \cdots + \frac{1}{2^n}$.

2. (5 points) Find the value of the following:

$$\prod_{i=3}^{7}(i - 1).$$

3. (12 points)

(a) Find a formula for $\frac{1}{1\cdot 2} + \frac{1}{2\cdot 3} + \cdots + \frac{1}{n(n+1)}$.

(b) Prove your result from part (a).

4. (10 points) Prove that if $A_1, A_2, \ldots, A_k$ are subsets of a universal set U, then

$$\overline{\bigcap_{k=1}^{n} A_k} = \bigcup_{k=1}^{n} \overline{A_k}.$$

5. (6 points) How many ways can a committee of 3 people be formed from a group of 10 people?

6. (6 points) How many ways can 3 officers, a president, vice president, and a secretary, be selected from a group of 10 people?

7. (12 points) What is the expansion of $(x-2)^7$?

8. (16 points) Solve the recurrence relation $a_n = 7a_{n-1} - 10a_{n-2}$ for $n \geq 2$ subject to $a_0 = 3$ and $a_1 = 12$.

9. (16 points) Solve the recurrence relation $a_n = 6a_{n-1} + 9a_{n-2}$ for $n \geq 2$ subject to $a_0 = 2$ and $a_1 = 9$.