Name: _____ Student ID: _____ Section: _____

Instructions. Grading is based on method. SHOW ALL WORK.

Please email your solutions to hensh@msu.edu by 12:30PM on Thursday (2025-07-10). Please use the subject line: **Math 481 - Quiz 04** and make sure that your name appears on your solution and that you follow the file naming convention.

1. (6 points) What is the largest coefficient in the expansion of $(x+y+z+w)^7$? EXPRESS YOUR ANSWER AS AN INTEGER.

2. (7 points) Give a combinatorial proof of the identity below.

$$4^k = \sum_{j=0}^{k} 3^j \binom{k}{j}$$

3. (4 points) Find the sum below. JUSTIFY YOUR RESPONSE.

$$\sum_{n_1+n_2+\cdots+n_k=n} \binom{n}{n_1, n_2, \ldots, n_k}$$

4. (3 points) How many terms are in the sum below? JUSTIFY YOUR RESPONSE.

$$\sum_{n_1+n_2+\cdots+n_k=n} \binom{n}{n_1, n_2, \ldots, n_k} x_1^{n_1} x_2^{n_2} \cdots x_k^{n_k}$$

For example, $\sum_{n_1+n_2=3} \binom{3}{n_1,n_2} x_1^{n_1} x_2^{n_2} = x_1^3 + 3x_1^2 x_2 + 3x_1 x_2^2 + x_2^3$ is a sum of 4 terms.