Submissions: This assignment is due on Tue Apr 21st. Each student must submit his or her own assignment. You must write your name and UUID clearly on your submitted assignment. Submit, by first arranging in order the problems, scanning or taking a clear photo, and uploading the files to the designated submission folder on elearn.

Academic Integrity: You are encouraged to work in groups, but everyone must write out their own solutions. Absolutely no word to word copying is allowed. Please refer to the course policies and schedules about this. If you have worked with other students on the assignment or referred to external sources, please mention all names and sources on your assignment.

Partial solutions: If you are sure that you know how to arrive at a solution, but you get stuck in some place, it is better to write the partial solution. Honest attempts at partial solutions will be awarded.

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Problem 1 [10 pts]: By using the various rules of finding which functions increase faster than others covered in class, show that \( n^{10}(\log n)^{100} = O(n^{12}) \).

Problem 2 [20 pts]: A hand of 5 cards is dealt from a standard pack of 52 cards. Find the probability that it contains 2 cards of 1 kind, and 3 of another kind.

Problem 3 [20 pts]: From a group of 15 people that includes Mr. A and Mr. B, a committee of 6 is selected, uniformly at random. Find the probability that the committee does not contain both Mr. A and Mr. B (i.e., it should not be the case that both Mr. A and Mr. B belong to the committee. It is ok for none of them or only 1 of them to belong to the committee.)

Problem 4 [15 + 15 = 30 pts]: By using one of the counting problems we considered, (i) find the number of solutions in non-negative integers to the equation \( x_1 + x_2 + x_3 + x_4 + x_5 = 30 \). Two solutions are different if they differ in at least one of the \( x_i \). Also, (ii) find the number of solutions where \( x_i \geq 2 \) for each \( i = 1, 2, 3, 4, 5 \).

Problem 5 [20 pts]: Use the Binomial theorem to find what is the sum,

\[
\binom{10}{0} - 2\binom{10}{1} + 4\binom{10}{2} - 8\binom{10}{3} \ldots + 1024\binom{10}{10} = \sum_{k=0}^{10} (-1)^k 2^k \binom{10}{k}
\]