

共 7 大題。總分 100 分。

1. [10 points] Count the number of ways to choose 10 elements from among 3 pears, 4 apples, and 5 bananas.
2. [10 points] Find the number of ways in which 9 A's and 6 B's can be placed in a row so that no 2 B's are together.
3. [10 points] Write the converse of the statement "If Athina finishes her homework, she will go to the dance party."
4. [10+10 points] (a) Use a C-like language to write the *Merge Sort* algorithm by a recursive function. (b) Prove that this algorithm works correctly.
5. [10 points] Prove that, at most, $n+1$ comparisons are required to determine if a particular number is in a sorted array of 2^n numbers by the *Binary Search* algorithm.
6. [10+10 points] Let $X = \{-1, 0, 1, 2\}$ and $Y = \{-4, -2, 0, 2\}$. Define the function $F : X \rightarrow Y$ as $F(x) = x^2 - x$. Prove that F is neither (a) 1-1 nor (b) onto.
7. [10+10 points] There are coins with values of 3 dollars and 5 dollars. (a) If you cannot combine some number of these coins to pay a bill, the item is free. For what number of dollars are items free? (b) Prove your answer.

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