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Qualitative Analysis for Problem 4

1. Estimation of the running time of naïve implementation

   For the pure recursive solution, the depth of recursive stack will equal to the postage value we want to make. For example, if we want postage value 8 and we have stamps which are 1,2,5 cents. The depth of recursion should equal to 8. At each recursive step, for each stamp, we have to decide to select it or not. So, the running should be S^P, in this example, 3^8. S stands for different kind of stamps that are available, and p represents the postage value. The running time is exponential.

2. In memorization implementation, the algorithm will avoid to repeatedly calculate many same sub-problems. It memorizes the results of the same sub-problems in a map and check it before each iteration.
   I used the following test cast:
   43
   20 8 5 4 3 2 1
   The memorization implementation gave me the correct result in one second. However, it took several minutes for naïve implementation to show the result.

3. When I used the Following test case, the memorization implementation starts to hang while DP implementation give me the answer immediately.
   10000
   1 5 9 3 6 7 8 15 18 19 13 12 11 14 21 26 27 25 28 29 30 31 34 35 36 38 39 42 47

   For DP implementation, the algorithm will first set all the value inside the DP array to INT_MAX which runs in O(P). For nested for loop, the outer loop run P times while the inner loop run in s. So, the nested loop run in O(P*S) in total and the entire algorithm also runs in O(P*S);