Name:

Student ID #:

- You are expected to work on this assignment on your own
- Use pseudocode, Python-like or English to describe your algorithms. Absolutely no C++/C/Java
- When designing an algorithm, you are allowed to use any algorithm or data structure we explained in class, without giving its details, unless the question specifically requires that you give such details
- Always remember to analyze the time complexity of your algorithms
- Homework has to be submitted electronically on Gradescope by the deadline. No late assignments will be accepted
Problem 1. (10 points)

You are given a directed graph $G$ with non-negative integer edge weights, a pair of vertices $s$ and $t$, and integers $K$ and $W$. Describe a dynamic-programming algorithm for deciding whether there exists a path from $s$ to $t$ that has total weight $W$ and uses exactly $K$ edges. Your algorithm should run in time $O((n + m)WK)$, where $n$ is the number of vertices and $m$ is the number of edges in $G$.

Answer:
Problem 2. (10 points)

Consider the following data compression technique. We have a table of $m$ text strings, each of length at most $k$. We want to encode a data string $D$ of length $n$ using as few text strings as possible. For example, if our table contains $(a, ba, abab, b)$ and the data string is $bababbaababa$, the best way to encode it is $(b, abab, ba, abab, a)$ - a total of five code words. Give an $O(nmk)$ dynamic-programming algorithm to find the length of the best encoding. You may assume that the string has an encoding in terms of the table.

Answer:
Problem 3. (10 points)

Let $A$ be a $n \times m$ array of 0’s and 1’s. Design a $O(nm)$ time dynamic-programming algorithm for finding the largest square block of $A$ that contains 1’s only.

Answer: