Question 1 (Knapsack, 30 points). *Consider the knapsack problem where you are allowed to take items more than once, have a total capacity of 10 and have the following items available:*

Item	*Weight*	*Value*
A	*2*	*4*
B	*3*	*5*
C	*4*	*9*
D	*5*	*10*
E	*7*	*16*

What is the best combination of items to take?

Question 2 (Business Plan I, 35 points). *Harold is starting a new business. He begins with* \$0 *in capital and wants it to be worth as much as possible at the end of* n *weeks, at which point he plans to sell. In order to get there, he has* k *different strategies he can use to make money. Each strategy takes one week to implement, and can be used multiple times as needed. If Harold has* x *dollars at the start of a week and implements the* i^{th} *strategy that week, he will have* $f_i(x)$ *dollars at the end of that week for some increasing function* f_i *(meaning that* $f_i(x) \geq f_i(y)$ *whenever* $x \geq y$*).*

Harold has a simple plan for determining which strategies to use in which order. Each week he will note the number of dollars, x*, that he has at the start of the week, and implement the plan with* $f_i(x)$ *as large as possible. Prove that this strategy gets Harold as much money as possible by the end of the* n^{th} *week.*

Question 3 (Business Plan II, 35 points). *The setup of this problem is similar to that in question 2. Please read that question first.*

Harold later realizes that things are not quite as predictable as he had previously thought. He determines that implementing plan i in a given week has a probability $p_{i,j}$ of earning him j dollars (adding j to his current amount of money) over the course of that week for each integer j between 0 and m. Harold starts with 0 dollars and his goal is to maximize the probability that he will have at least m dollars at the end of n weeks.

Give an algorithm that given n, m and all of the $p_{i,j}$ computes the maximum possible probability with which Harold can achieve this goal. For full credit, your algorithm should run in time $O(nm^2k)$ where k is the number of possible strategies available.