

Operations Research

Homework 7

Due via Moodle or Mailbox Thursday, November 12, 2020

1. (HL, Exercise 10.3-3.) A college student has 7 days remaining before final examinations begin in her four courses, and she wants to allocate this study time as effectively as possible. She needs at least 1 day on each course, and she likes to concentrate on just one course each day, so she wants to allocate 1, 2, 3, or 4 days to each course. Having recently taken an OR course, she decides to use dynamic programming to make these allocations to maximize the total grade points to be obtained from the four courses. She estimates that the alternative allocations for each course would yield the number of grade points shown in the following table.

| Study Days | Estimated Grade Points | | | |
|------------|------------------------|----------|----------|----------|
| | Course 1 | Course 2 | Course 3 | Course 4 |
| 1 | 1 | 5 | 4 | 4 |
| 2 | 3 | 6 | 6 | 4 |
| 3 | 6 | 8 | 7 | 5 |
| 4 | 8 | 8 | 9 | 8 |

Solve this problem by dynamic programming.

2. (HL, Exercise 10.3-10.) Consider the following *integer* nonlinear programming problem.

$$\text{Maximize } z = 32x_1 - 2x_1^2 + 30x_2 + 20x_3$$

subject to

$$3x_1 + 7x_2 + 5x_3 \leq 20$$

and

$$x_1, x_2, x_3 \text{ are nonnegative integers.}$$

Use dynamic programming to solve this problem.

3. This problem is “extra credit” up to a total of 10 points for this homework set.

(From HL, Exercise 10.3-12.) Re-solve the Local Job Shop employment scheduling problem from class when the cost of changing the level of employment from one season to the next is changed to 100 times the square of the difference in employment levels.

You may use Sympy and modify the example file on the course web site. If you use the file provided, please be sure to adapt the annotation text. If the comments are left unchanged and diverge from the computation results, your solution will be downgraded even if the final result is correct.