Math 323 (Jones 307 MWF 11-11:50)

Operations Research I–Deterministic Models

Additional Homework 7 Problems

1. You and several friends are about to prepare a lasagna dinner. The tasks to be performed, their times (in minutes), and the precedence relationships are as follows:

Task #	Task Description	Time	Preceding Tasks
1	buy mozzarella cheese	30 min.	none
2	slice mozzarella cheese	5 min.	1
3	beat 2 eggs	2 min.	none
4	mix eggs & ricotta cheese	3 min.	3
5	cut up onions & mushrooms	7 min.	none
6	cook the tomato sauce	25 min.	5
7	boil large quantity of water	15 min.	none
8	boil the lasagne noodles	10 min.	7
9	drain the lasagne noodles	2 min.	8
10	assemble all ingredients	10 min.	9,6,4,2
11	preheat the oven	15 min.	none
12	bake the lasagne	30 min.	10,11

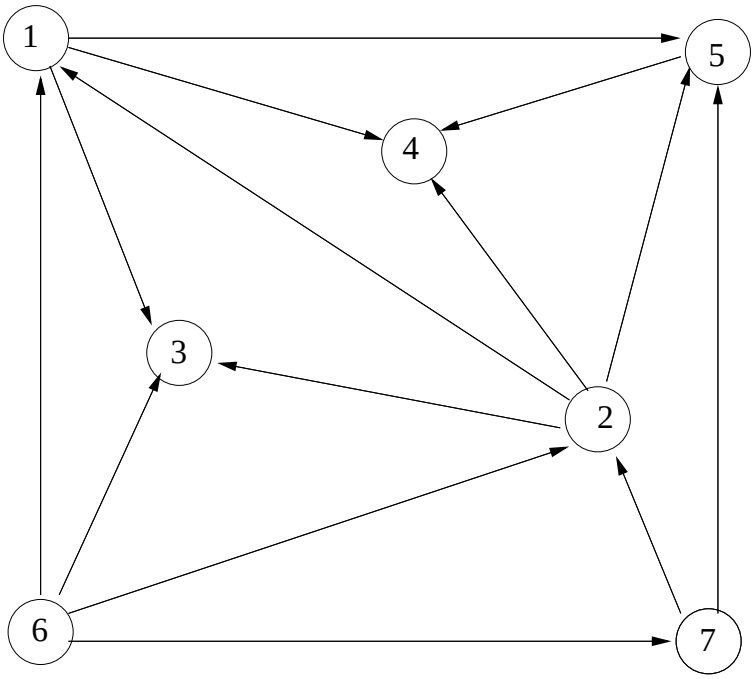
   (a) Formulate this problem as a CPM project network (ch. 9).

   (b) Solve the problem with Algorithm 9E. Show your work. Give the longest path length and the activities on it.

   (c) Because of a phone call you were interrupted for 6 minutes when you should have been cutting the onions and mushrooms. By how much will dinner be delayed? If you use your food processor, the cutting time is reduced from 7 minutes to 2 minutes, will dinner still be delayed? Why or why not?

   (d) Formulate the original problem as a linear program. Solve with LINDO. Did you get the same answer? Explain.

2. Consider the following minimum cost network flow problem pictured below. The demands (supplies) at the seven nodes are $(0,0,6,10,8,-9,-15)$ respectively. The edge costs are $(c_{13},c_{14},c_{15},c21,c_{23},c_{24},c_{25},c_{54},c_{61},c_{62},c_{63},c_{67},c_{72},c_{75})$ $=(53,18,29,8,60,28,37,5,44,38,98,14,28,59)$. The intial basic feasible tree solution is $\vec{x}=(x_{13},x_{14},x_{15},x_{21},x_{23},x_{24},x_{25},x_{54},x_{61},x_{62},x_{63},x_{67},x_{72},x_{75})$ $=(0,1,8,0,6,9,0,0,9,0,0,0,15,0)$.



(a) Why is the given intial solution feasible? basic?

(b) Solve the minimum cost network flow problem using the network simplex method. (If you select the nonbasic variable that gives you the greatest rate of decrease you should have two iterations of improvement and one iteration verifying that you have an optimal solution.)

(c) Formulate the above problem as a linear program and solve with LINDO. Hopefully you will get the same answer.