

IE 400: Principles of Engineering Management

Homework 2

Spring 2022-2023

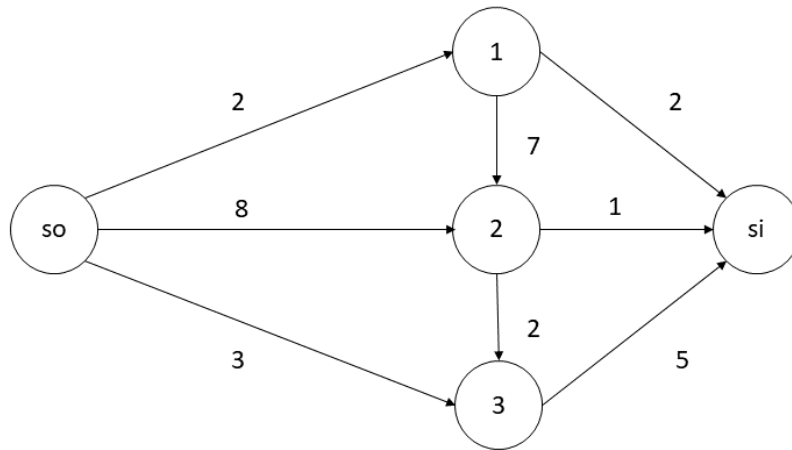
Deadline: 14 May 2023

Question 1. The promise of personalized therapies for cancer is based on examining the relevant medicine of the individual to see which symptoms have reduced. So, understanding the roles of medicine and symptoms is critical to understanding the causes, treatments, and hopefully preventions, of cancer. Each combination of anti-cancer drug is expected to have a different impact on different patients. Now, assume you are working on the most effective anti-cancer drug, which includes 4 ingredients: Fludarabine, Pralatrexate, Dactinomycin, Vincristine. A unit of an acceptable drug has at most 7 millilitres (ml) of these ingredients. You need to decide which ingredient should be included. Dosages of each ingredient in a unit of drug and their utilities are given below:

Index	Ingredient	Dosage (ml)	Utility
1	Fludarabine	3	17
2	Pralatrexate	2	10
3	Dactinomycin	6	25
4	Vincristine	5	24

Construct an IP to determine which ingredients to include to the most effective drug to maximize the total utility while the total volume of the ingredients does not exceed the unit capacity of a drug. Then, solve the IP problem by using Branch and Bound method.

Question 2. Consider the following network. The main server of Bilkent University is located at the sink node (si). There is a cyber attack on the computer at the source node (so). The arcs of the network show the connections among the servers and the numbers on the arcs are the costs required to the block that connection. Determine the minimum cost required to prevent the cyber attack from reaching the main server at node (si). Indicate which arcs you choose the block and the total cost. Show your steps clearly.



Question 3. Consider the list of activities and predecessors that are involved in forging process.

Activities	Description	Duraiton	Immediate Predecessor	Cost Per Day of Reducing the Duration of Activity	Maximum Possible Reduction in Duration (days)
A	Forgings transported from forge shop	2	-	5	1
B	Inspection of incoming forgings	4	A	15	2
C	Forgings moved and placed in storage	10	B	21	1
D	Forgings transported to machine shop	6	C	7	1
E	Milling operation	4	C	16	3
F	Drilling operation	5	C	23	3
G	Inspection of machining operations	7	D	10	2
H	Cleaning operation	9	E, G	15	1
I	Transport to storage	7	F	8	1
J	Assembly	8	H, I	25	2

- Draw a project network, determine the critical path and project duration.
- Which activities can be delayed without delaying the entire project? If yes, how many days the activities can be delayed?
- Assume that the project must be completed in M days. Formulate an IP that can be used to minimize the cost of meeting the project deadline.

Question 4. Find the shortest path tree on this network by using Bellman Ford algorithm. Show your work step by step.

