Homework for Network Optimization Models

1. [From Hillier] You and several friends are about to prepare a lasagna dinner. The tasks to be performed, their immediate predecessors, and their estimated durations are as follows:

Task	Task Description	Tasks That Must Precede	Time (minutes)
A	Buy the mozzarella cheese*	—	30
B	Slice the mozzarella	A	5
C	Beat 2 eggs	—	2
D	Mix eggs and ricotta cheese	C	3
E	Cut up onions and mushrooms	—	7
F	Cook the tomato sauce	E	25
G	Boil large quantity of water	—	15
H	Boil the lasagna noodles	G	10
I	Drain the lasagna noodles	H	2
J	Assemble all the ingredients	I, F, D, B	10
K	Preheat the oven	—	15
L	Bake the lasagna	J, K	30

*There is none in the refrigerator.

a. How long till dinner is ready?
b. …you got distracted by your phone and were interrupted for six minutes when you should have been cutting the onions and mushrooms. By how much will dinner be delayed?

2. [From Hillier] A movie production company is attempting to finish their big Christmas movie in time for Thanksgiving weekend (15 weeks from now). [FYI Thanksgiving is only 3 weeks away] The network model and costs are below. Assume crash times are linear, so Activity D would cost 6 million per week crashed.
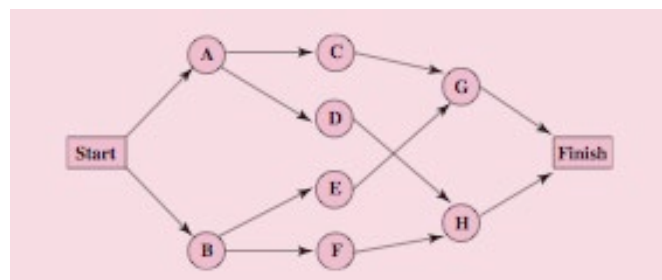
Activity	Normal Time (weeks)	Crash Time (weeks)	Normal Cost (millions)	Crash Cost (millions)
A	5	3	$20	$30
B	3	2	10	20
C	4	2	16	24
D	6	3	25	43
E	5	4	22	30
F	7	4	30	48
G	9	5	25	45
H	8	6	30	44

a. Find a minimal cost to finish the movie on time.
b. Why is the most expensive crash, activity, B, crashed for 1 week?
c. Why is the least expensive crash, Activity C, not crashed?

3. [From Hillier] Find a quickest route from Seattle to Denver: the map below shows driving time (in hours) between various city points.

Seattle

Butte

Billings

10

3

9

7

4

Portland

7

7

7

Boise

12

7

6

14

Cheyenne

Salt Lake
City

7

5

1

4

Grand
Junction

Denver