

National Exams December 2011

**98-Civ-B8, Management of Construction**

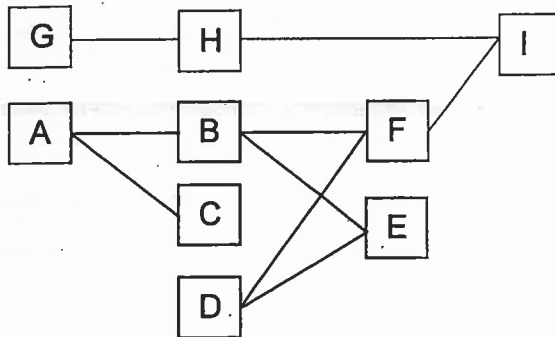
**3 hours duration**

**Notes:**

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made;
2. This is a "Closed Book" exam. Candidates may use one of two calculators, the Casio or the Sharp approved models;
3. Any five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked.
4. All questions are of equal value.

**1. Scheduling:**

The duration and direct-cost data for a small network is given in the following table. Any duration between the normal duration and the crash duration is possible for each activity. Indirect costs are equal to (\$2500 + \$400 / day). Determine the optimum project crashing strategy (i.e., project duration with least total cost).



Activity	Normal		Crash	
	Dur.(d)	Cost (\$x100)	Dur. (d)	Cost (\$x100)
A	6	18	3	33
B	4	16	2	32
C	5	10	5	10
D	4	40	4	40
E	8	16	3	36
F	2	2	1	5
G	4	15	4	15
H	4	16	3	21
I	4	16.5	2	30.5
		149.5		222.5

**2. Estimating and Bidding:**

The main five activities in a highway construction are shown below, along with information regarding the quantity of work, production rates, and unit costs.

- (a) Estimate the duration and cost of each activity;
- (b) If all crews are expected to work with only 60% productivity, what is the impact on durations and costs; and
- (c) Briefly discuss the factors that affect the productivity of crews.

Activity	Quantity	Cost and Production Data
1. Excavation	2100 m <sup>3</sup>	Crew production rate = 742 m <sup>3</sup> / day; Cost = \$12 / m <sup>3</sup>
2. Sub-base	600 m <sup>2</sup>	Crew production rate = 3,94 m <sup>2</sup> / day; Cost = \$1.3 / m <sup>2</sup>
3. Base	6000 m <sup>2</sup>	Crew production rate = 600 m <sup>2</sup> / day; Cost = \$12 / m <sup>2</sup>
4. Binder	6000 m <sup>2</sup>	Crew production rate = 5,305 m <sup>2</sup> / day; Cost = \$5 / m <sup>2</sup>
5. Asphalt	3600 m <sup>2</sup>	Crew production rate = 8,842 m <sup>2</sup> / day; Cost = \$4 / m <sup>2</sup>

**3. Safety Practices and Regulations:**

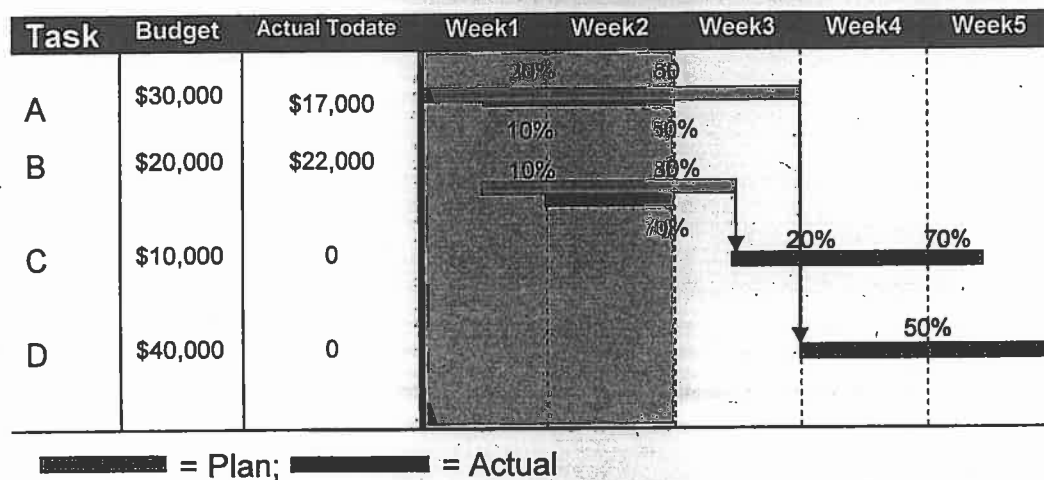
Briefly discuss the main reasons for safety problems on construction sites and some of the important practices that need to be adopted on the site of a large bridge rehabilitation project to assure an accident-free environment in the work zone area.

**4. Engineering Economics:**

Annual maintenance costs for a particular section of highway pavement are \$3,000. The placement of a new surface would reduce the annual maintenance cost to \$750 per year for the first 5 years and to \$1,100 per year for the next five years. The annual maintenance after 10 years would again be \$3,000. If maintenance costs are the only saving, calculate the maximum investment that can be justified for the new surface, with interest at 5%.

**5. Project Control:**

Planned and actual bar charts for a small project are as follows:



- Draw the BCWS, BWCP, and ACWP curves for this project at the end of week 2.
- Comment on the actual versus planned progress at end of week 2?
- Calculate the cost performance and the schedule performance indexes at end of week 2.

**6. Cash Flow:**

Sketch and briefly explain the general trend of a typical project expenditure curve. Also, sketch the project typical income profile and discuss the factors that can improve the project cash flow and reduce the amount of interest charged on project financing. Also, discuss the effect of receiving a down payment on cash flow profiles.