07-Bld-A3 Construction Engineering

National Exams December 2012

3 hours duration

NOTES:

1. **If doubt exists as to the interpretation of any questions, the candidate is required to submit with the answer paper, a clear statement of any assumptions made;**
2. **This is a CLOSED BOOK EXAM. Only Casio or Sharp Calculator is allowed;**
3. **This paper has SEVEN questions. Answer any FIVE questions, which constitute the paper.**
4. **All questions carry equal marks;**
5. **For essay questions, clarity and organization of the answers are important.**

1. Table below (Table 1.1) shows a set of activities, their expected durations, and immediate predecessors.
   (1) Construct an activity network (10 marks);
   (2) Identify the critical path and all activity slack times (10 marks).

Table 1.1

Activity	Predecessors	Expected Duration
A	---	6
B	A	7
C	A	5
D	B	3
E	C	4
F	C	5
G	D, E	8
H	F, G	3

2. Smith has been managing a construction project, BCC, now for over 12 months and is starting to become concerned with how far behind the schedule it is slipping. Through a series of mishaps, late supplier deliveries, bad weather, ad other unforeseen circumstances, the project has experience one delay after another. Although the original plan called for the project to be completed within the next four months, Smith's site supervisor is confident that BCC cannot possibly make that completion date. Late completion of the project has some severe consequences, both for BCC and for Smith. For the company, a series of penalty clauses kicks in for every week the project is late past the contracted completion date. For Smith personally, a late completion to his first project assignment can be very damaging to his career.

   Smith just finished a meeting with his direct supervisor to determine what options he had at this point. The good news is that the BCC bid for the construction project came with some additional profit margin about what was common in the industry so Smith boss has given him some 'wiggle room' in the form of $30,000 in discretionary budge money if needed. The bad news is that the

delivery date for the project is fixed and cannot be altered without incurring substantial penalties, something BCC is not prepared to accept. The message to Smith is clear: You can spend some additional money but you can't have any extra time. Smith has just called a meeting with the site supervisor and other key project team members to discuss the possibility of crashing the remaining project activities. He calculates that crashing most the final activities will bring them in close to the original contracted completion date but a substantial cost. He needs to weigh these options carefully with his team members to determine if crashing makes the best sense.

(1) What are some of the issues that weigh in favour of and against crashing the project? (10 marks)

(2) Suppose you were the site supervisor for the project. How would you advise Smith to proceed? Before deciding whether or not to crash the project, what questions should you consider and how should you evaluate your options? (10 marks)

3. (1) What are the differences between arbitration and mediation? (5 Marks)

(2) Can a contractor refuse to do change order work? Explain. (7 Marks)

(3) Construction claims can end in litigation. Why is litigation viewed as the solution of last resort? (8 Marks)

4. Multiple Choices (Each question carries 2 marks; 10@2=20 marks)

(1) The majority of the project budget is expended upon:

a. Project plan development;
b. Project plan execution;
c. Project termination;
d. Project communication.

(2) Which of the following is the most critical component of the triple constraint?

a. Time, then cost, then quality;
b. Quality, then cost, then time.
c. Scope;
d. They are all of equal importance unless otherwise stated.

(3) All of the following are elements in the definition of a construction project, except:

a. A project is time limited;
b. A project is unique;
c. A project is composed of unrelated activities;
d. A project is undertaken for a purpose.

(4) Which of the following best describe a construction stakeholder:

a. A team member;
b. The project manager;
c. Someone who works in an area affected by the project;
d. All of the above are stakeholders.

(5) What is the lowest level of decomposition in the Work Breakdown Structure called?

a. Work package;
b. Deliverable;
c. Subdeliverable;
d. Project.

(6) A hospital expansion is being planned for a community. As part of the scope of this project, ti will be necessary to close own the access routes into the emergency room for major remodelling; however, because this si the only hospital for trauma cases within 50 miles, it is not possible to completely shut down the emergency room. The project team will have to find a means to remodel the emergency room while allowing for continuous operations of the unit. This is an example of what?

a. Negotiation points with the owner;
b. Constraints;
c. Initial assumptions;
d. Milestone development.

(7) The project manager for a large project being developed in northern Ontario recognizes that it will be necessary for him to maintain a close presence at the construction site during its development and has negotiated the use of a building for his team near the construction project. The cost of the building must be factored into the project cost and will increase with use; that is, the cost of heating and other utilities is subject to change depending upon weather and team use. What type of cost would this building represent?

a. Variable direct;
b. Indirect;
c. Nonrecurring;
d. None of the above.

(8) A project budge identifies $5,000 budgeted for programming costs. The actual amount for programming costs is $5,450. Which of the following statements is correct?

a. The $450 represents a negative variance to the budge;
b. There is no variance to the budget;
c. The $450 represents a positive variance to the budget;
d. The entire $5,450 represents a positive variance to the budget.

(9) The project administrator is preparing a preliminary budget for a project and adds in the cost of a new computer for the project team to use. What type of cost would this computer purchase represent?

a. Variable;
b. Direct;
c. Indirect;
d. Variable direct.

(10) Suppose you evaluated the best case, most likely, and worst case during estimates for an activity and determined that there were 3 days, 4 days, and 8 days respectively. Using PERT estimation techniques, what would be the expected duration for the activity?

a. 4 days;
b. 8 days;

c. 5 days;

d. 4.5 days.

5. Consider the following project activity table, identifying each activity, its normal duration and cost, and expedited durations and costs:

(1) What is the cost per day to crash each of the activities? (10 marks)

(2) Assuming they are all part of the critical path, which activities should be crashed first? (10 marks)

(Crash cost is calculated based on the formula:

$$\text{Slope} = \left(\frac{\text{Crash Cost} - \text{Normal Cost}}{\text{Normal Time} - \text{Crash Time}} \right)$$

Activity	Normal		Crashed	
	Duration	**Cost**	**Duration**	**Cost**
A	3 days	$1,500	2 days	$2,000
B	5 days	3,500	4 days	5,000
C	4 days	6,800	3 days	7,500
D	5 days	2,500	3 days	6,000
E	7 days	4,200	6 days	5,400
F	4 days	2,000	3 days	2,700

6. (1) The required labour time for 2 technologists to complete a job is 8 hours total at a rate of $19.50/hour. Assuming project overhead charges are 75% and allowance for personal time is 10%, calculate the total cost? (8 marks)

(2) Assuming that another project requires duration of 24 hours to complete, and the project is finished in 20 hours, identify the number of workers with the time spent by each on the project?

Show your method and calculation by using the given formula of: Work = Duration x Units. (7 marks)

(3) Suppose you want to crash the activity and need to complete the project in one working day. Using the same formula from above, show how this could be done without requiring overtime hours. (5 marks)

7. A contractor that specialize high-rise condominium in Ontario has been awarded a contract to construction a 20-story condominium with three lower level retails in a well built up area in Toronto. The contract is for two years with a fixed date for completion after which a $100,000 per day penalty will apply. This is considered to be a major undertaking, is of strategic importance, and will require a matrix organization. The company has selected you as the Project Manager and a team to follow the project through to completion. You decide to employ a scheduling technique that should fulfill the following criteria: simple to follow; able to show the duration and sequence of events; able to indicate planned and actual flow; and able to show which items may proceed together and how far they are from completion. The Assistant Project Manager favors use of a Gantt chart, whereas the financial controller prefers PERT, and the Technology Department would like to use CPN.

Evaluate the techniques stated above (and any others that may be appropriate) and provide a persuasive argument for your choice of what should be used. (20 marks)