UNIVERSITY OF SOUTH AUSTRALIA
SCHOOL OF NATURAL AND BUILT ENVIRONMENTS

PROGRAM(S): **Bachelor of Construction Management & Economics & Diploma in Built Environment**

COURSE: **CONSTRUCTION MANAGEMENT 2N (BUIL 2007)**

EXAMINATION: **Internal Examination, Semester 1 of 2004**

DURATION: **10 minutes of Reading time plus 3 Hours of Exam time, a total of 3 Hrs 10 Min. For ENTEXT students 10 min of Reading time plus 3.5 Hrs of Exam time, a total of 3 Hrs 40 Mins.**

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EXAM REVIEWED BY: **Virginia Mehrtens**

INSTRUCTIONS TO CANDIDATES:

- This exam is worth 60% of the total course marks
- Attempt all questions
- The value of each question is noted below.
- A calculator is allowed but no reference materials.
- If you find a question unclear, please state your assumption and answer the question based on that.

NOTES FROM EXAMINER:

Question 1 **(10 Marks)**

a) Explain the following eight terms;

1) Front-end loading
2) Criterion Rate of Return
3) Lead & Lag time (as used in MS Project)
4) Internal Rate of Return
5) Effective Margin
6) DCF-yield
7) Sensitivity analysis
8) Linked barchart

b) A construction project may begin with the development of the initial concept and may end when the main contractor hands a building over to the client. During the life of such a project there is planning/scheduling carried out by several different groups of people. Name four of the main groups that carry out this planning and describe the purposes of the planning they do.

Question 2 **(20 Marks)**

a) Carry out a critical path analysis for the following project in order to determine the total completion time for the project and the critical activities. Illustrate the critical path(s) in the CPM network. Calculate and list the Total and Free floats for all activities.

Activity	Duration	Depends on activity	Cost
A	3 weeks	-	$3 000
B	5	A	5 000
C	4	A	8 000
D	5	C	7 500
E	3	B	9 000
F	4	B and C	8 000
G	2	E and F	8 000
H	5	D and E	5 000
I	2	G	4 000
J	3	H and K	6 000
K	5	D	5 000
L	3	K	6 000
M	2	J and L	3 000
N	3	M	1 500

b) Carry out a cash flow analysis for the above project in order to determine the maximum overdraft required, the time when the project breaks even and the final margin. You can assume that it is a 'cost-plus' type contract so the contractor invoices the client, for his costs plus a margin of 10%, after every four weeks. The client makes his/her payment in the following 4-week period but is allowed to withhold 5% as retention of each payment. The retention money is paid to the client in the 4-week period following completion.

Question 3 **(15 Marks)**

a) You represent a building contractor and you have determined that the costs for a particular project are as follows:

Month:	1	2	3	4	5	6
Cost:	$70 000	$90 000	$120 000	$190 000	$120 000	$50 000

The contract sum will be based on these costs plus a 10% margin.

Your client proposes the following two alternative payment plans:

Alt A: 'Cost plus' so that you invoice the client at the end of each month and receive payment in full in the following month.

Alt B: You receive the contract sum as four equal payments in month 1, 3, 5 and 7.

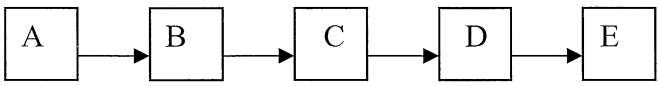
In order to compare these two alternative payment plans in today's money value, you must calculate the Net Present Value of each alternative. Base your discounting on a rate of 15% per annum. Which alternative would be most advantageous for you and why?

b) Assume that the annual rate used for discounting was 20% instead of 15%. How would that have affected the NPVs calculated in a), i.e. would they have been greater, smaller or unchanged and which one would have been affected more, if differently? Would this have affected the ranking of the two alternatives?

Note that no calculations are required here but you must justify your answer.

Question 4 **(15 Marks)**

A housing development consists of 50 houses and the construction of each partly prefabricated house is scheduled as follows:



A = Footings. Duration = 2 days
B = Superstructure. Duration = 5 days
C = Services. Duration = 3 days
D = External cladding. Duration = 4 days
E = Finishing touches. Duration = 1 day

You have access to only one team of workers for each activity so each team must progress from house to house.

a) What is the shortest possible completion time for this project?

b) Now assume that all workers must be provided with continuous employment. What is now the shortest possible completion time for the project, if scheduled as per the precedence diagram above?

c) Next you should assume that you could change the duration for activity 'C' so that for the first 25 houses it takes 4 days/house and for the following 25 houses it takes only 2 days/house, thereby retaining the average of 3 days/house. How quickly can you now complete all 50 houses if all workers must have continuous employment?

d) Finally, assume that you can change the duration of all activities on the condition that the cycle time, i.e. the time it takes to build one house, remains unchanged. All workers must still be provided with continuous employment. How would you change the durations in order to minimise the project completion time and how long would it then take?

END OF QUESTIONS

FORMULAE SHEET

This is a standardised formulae sheet and not all formulae may be useful in this particular exam.

Economic Assessment

Compound amount of a lump sum (= Compound amount of 1)

$$(1 + i)^n$$

Present worth of a lump sum (=Present worth of 1)

$$\frac{1}{(1 + i)^n}$$

Compound amount of a regular series (= Compound amount of 1 per period)

$$\frac{(1 + i)^n - 1}{i}$$

Sinking fund deposit (= Uniform series that amounts to 1)

$$\frac{i}{(1 + i)^n - 1}$$

Present worth of a regular series (=Present worth of 1 per period)

$$\frac{(1 + i)^n - 1}{i(1 + i)^n}$$

Capital recovery (=Uniform series that 1 will buy)

$$\frac{i(1 + i)^n}{(1 + i)^n - 1}$$

Legend:
i = interest rate per period
n = number of periods

PERT

$$t_e = \frac{O + 4*M + P}{6}$$

$$S = \frac{P - O}{6}$$

$$T = \Sigma t_e \pm \sqrt{\Sigma(S^2)}$$