

## **MIDTERM #2**

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### **GENERAL INSTRUCTIONS**

This exam is to be completed in a bluebook – answers not recorded in a bluebook will not be graded. Place the exam sheets on the inside of your bluebook when finished and hand them in back with the bluebook. If you have a question during any portion of this exam, raise your hand and speak to the proctor. Write legibly.

#### **Question #1 [10 points]**

**In cost estimation, what make projects similar? List five criteria and give an example of each one.**

**One criteria (1'), One example (1').**

- A:
1. Similar project type. Example: both are residential buildings.
  2. Similar schedule duration. Example: both last two years.
  3. Similar location. Example: both in CA.
  4. Similar market condition. Example: The material price, job markets are similar.
  5. Similar contract format. Example: Both lump sum, turn key, cost plus incentive fee.
  6. Similar site characteristics. Example: soil type, layout.
  7. Similar weather. Example: rain, temperature.
  8. Similar Design. Example: both are steel concrete structures or masonry structures or wood structures.
  9. Similar Daily schedule: For example both use overtime (5 days a week vs. 6 days a week).
- Etc.

**Question #2 [20 points]**

List 4 different ways to measure a project's % complete. Give an example for each one. What are the advantages and disadvantages of each?

Name each method (2'). Each example (1'), only one advantage (1') and one disadvantage (1') are required for each method.

| Methods                              | Example   | Advantage  | Disadvantage   |
|--------------------------------------|---|--|--|
| 1. Judgment/Guess-timation<br>(2')   | Estimate the painting work of a project is 20% done (1')  | 1. Does not cost much<br>2. Quick<br>(1')                | 1. Very partial, personalized.<br>2. Not accurate (1') |
| 3. Quantity-based estimation<br>(2') | Measure exactly how much concrete work has been done. (1')  | 1. Exact/accurate<br>2. Objective<br>(1')                | 1. Takes time<br>(1')                                  |
| 3. Time or \$ based<br>(2')          | 120 hours of labor hours have been spent. Total hours needed is 300 as estimated. So 40% is done (1')                 | 1. Easy and quick<br>2. Inexpensive to calculate<br>(1') | 1. Lag<br>2. Lumpy/Cannot have a smooth curve.<br>(1') |
| 4. Rules of credit/Milestone<br>(2') | Check with planned activities to see which milestone has been met and thus find out how much has been completed. (1') | 1. Easy and quick<br>2. Inexpensive to calculate<br>(1') | 1. Only if milestone was set<br>2. Inaccurate<br>(1')  |

**Question #3 [15 points]**

Please answer the following questions:

(a) What is a failure to meet a capital call? (3')

A: The capital call is a request made from time to time by the managing partner for each partner to contribute funds to the joint venture for operating capital. Refusal or unable to make meet a capital call is called failure to meet a capital call.

(b) What does jointly and severally bound mean? (3')

A: It means that the partners agree to be jointly and severally liable with respect to the duties, obligations, and liabilities of the joint venture. Joint and several liability means to each partner company that, if the other partners are unable or unwilling to meet their share of joint-venture obligations, each partner company can be held liable, not only for that partner's share but also for the other partners' shares as well-for the joint venture's total obligation. Without Joint and several liability, owners would not award construction contracts to joint ventures.

(c) A public owner must insure that the low bidder is both \_\_\_\_\_ and \_\_\_\_\_. (3')

Responsive and responsible. 1.5' each

**(d) What is material impropriety? (3')**

A: a material impropriety can be anything that is not proper in either the bidding documents or the bidding process. Examples include such acts as bribery, bid rigging, or offering private clarification of bid document requirements to selected bidders, or anything else that would impugn the integrity of the bidding process. A material impropriety can also include unfair or improper resolution of errors or ambiguities in the bidding documents or in the bids received that make it impossible to be certain that each bid is for exactly the same intended work.

**(e) What general rules must a bidder follow to withdraw his/her bid without suffering financial consequence? (3')**

Only two rules are required, 1.5' each.

A:

1. The claimed mistake must be material.
2. The claimed mistake must be subject to objective determination.
3. The claimed mistake must be clerical in nature as opposed to a mistake in judgment.
4. It must be clear that the owner would unconscionably profit from the mistake if the bidder were not allowed to withdraw.
5. The position of the owner must not be prejudiced except for the loss of bargain resulting from allowing the bidder to withdraw.
6. The bidder's mistake should not have resulted from a failure to perform some positive legal duty or from gross or culpable negligence.

**Question #4 [40 points]**

Consider the precedence relationships given in the Table below.

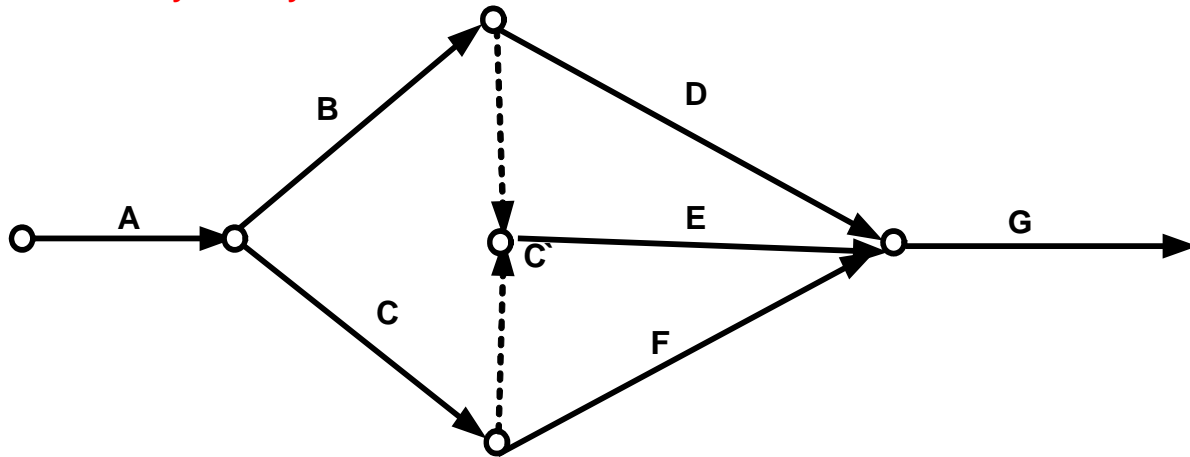
| Activity | Predecessors | Durations (weeks) |
|----------|--------------|-------------------|
| A        | --           | 4                 |
| B        | A            | 7                 |
| C        | A            | 3                 |
| D        | B            | 8                 |
| E        | B, C         | 2                 |
| F        | C            | 9                 |
| G        | D,E,F        | 4                 |

(a) Draw AOA (Activity-On-Arrow) diagram. [5 points]

Basic Logic = 1

Each Arrow (Activity) =  $0.5 * 8 = 4$

Unnecessary Dummy = - 0.5



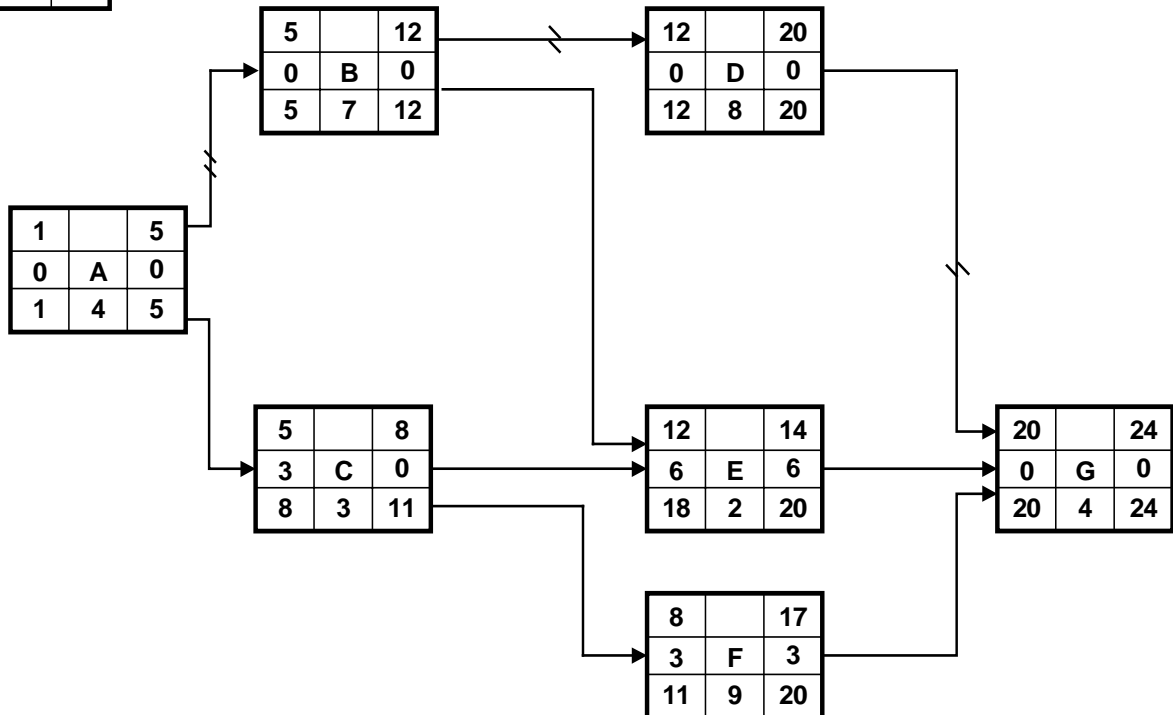
(b) Draw AON (Activity-On-Node) diagram and calculate ES, EF, LS, LF, TF, and FF (Start on day 1). Identify the Critical Path. Tabulate your answers. [12 points]

ES, EF, LS, LF, TF, FF = 0.25 Each \*42 = 10.5

Critical Path = 1.5

(No Table = -1)

|    |   |    |
|----|---|----|
| ES |   | EF |
| TF | # | FF |
| LS | D | LF |



Critical path: A-B-D-G

| Activity | ES | EF | LS | LF | TF | FF |
|----------|----|----|----|----|----|----|
| A        | 1  | 5  | 1  | 5  | 0  | 0  |
| B        | 5  | 12 | 5  | 12 | 0  | 0  |
| C        | 5  | 8  | 8  | 11 | 3  | 0  |
| D        | 12 | 20 | 12 | 20 | 0  | 0  |
| E        | 12 | 14 | 18 | 20 | 6  | 6  |
| F        | 8  | 17 | 11 | 20 | 3  | 3  |
| G        | 20 | 24 | 20 | 24 | 0  | 0  |

(c) The meaning of this schedule. [4 points]

1. The total duration is 23 (24-1) days. The activity on critical path is A (4 days), B (7 days), D (8 days), and G (4 days), total 4+7+8+4=23. It is important to make sure

these activities start and finish on time. Otherwise, the total the project will be delayed. (2')

2. For the activities on critical path, there is no FF or TF. For other activities, activity C: TF=3 & FF=0; E: TF=6 & FF=6; F: TF=3 & FF=3.

Therefore, C can delay 3 days without delay the whole project. But there is 0 FF, which means there is no slack for C in order to make its successor activities start on time.

E can delay 6 days without delay either following activities or the whole project.

F can delay 3 days without delay either following activities or the whole project. (2')

**(d) Lead-Lag Relationships:** Suppose some lead-lag relationships were added to the original relationships given in the table above. Draw the updated AON, calculate ES, EF, LS, LF, TF, and FF, and tabulate your answers. Find the CPs. [13 points]

ES, EF, LS, LF, TF, FF = 0.25 Each \*42 = 10.5

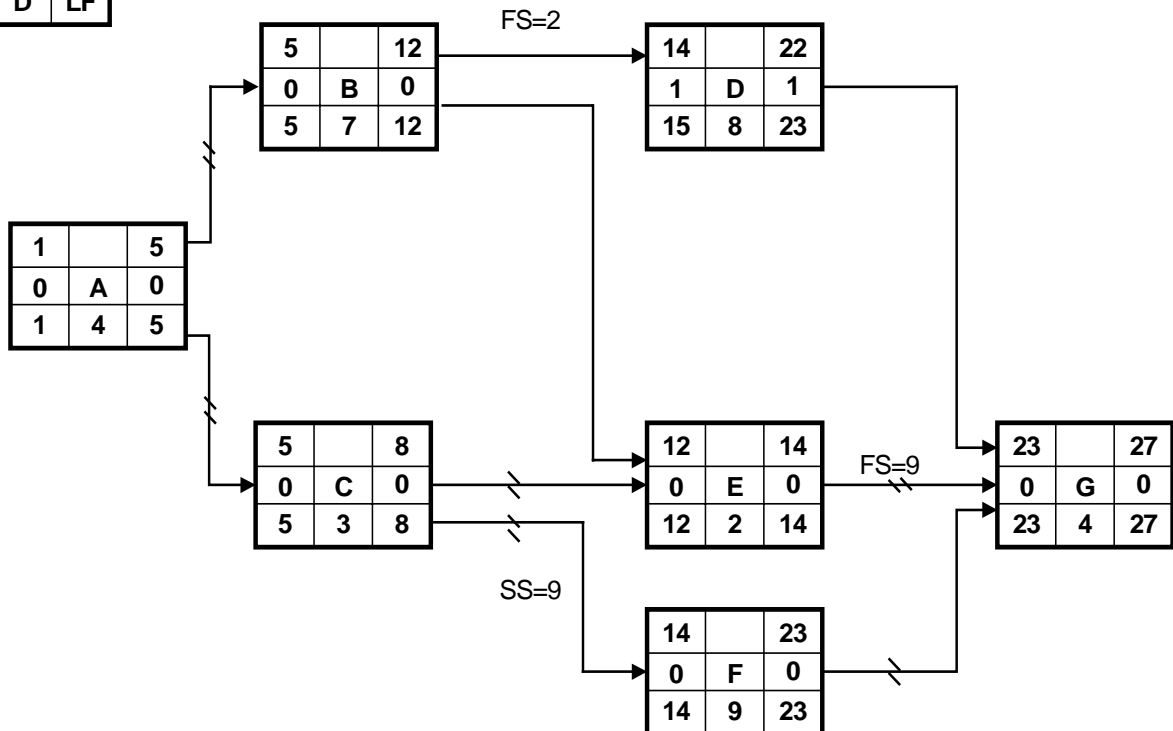
Critical Path = 1\*3=3

(No Table = -1)

These newly added relationships are tabulated below.

| Related Activities | Lead-Lag Relationships |
|--------------------|------------------------|
| B-D                | FS=2                   |
| C-F                | SS=9                   |
| E-G                | FS = 9                 |

|    |   |    |
|----|---|----|
| ES |   | EF |
| TF | # | FF |
| LS | D | LF |



Critical path: A-C-E-G  
 A-C-F-G  
 A-B-E-G

| Activity | ES | EF | LS | LF | TF | FF |
|----------|----|----|----|----|----|----|
| A        | 1  | 5  | 1  | 5  | 0  | 0  |
| B        | 5  | 12 | 5  | 12 | 0  | 0  |
| C        | 5  | 8  | 5  | 8  | 0  | 0  |
| D        | 14 | 22 | 15 | 23 | 1  | 1  |
| E        | 12 | 14 | 12 | 14 | 0  | 0  |
| F        | 14 | 23 | 14 | 23 | 0  | 0  |
| G        | 23 | 27 | 23 | 27 | 0  | 0  |

(e) Discuss the changes by lead-lag relationships. What are the changes in CP, Duration, and Floats? And what do they mean to management? [6 points]  
 CP (2'), Duration (1'), Float (2'). Management (1').

### Discussion

Now there are three critical paths. Duration is increased by three day. The newly added lead-lag relationships C-F SS=9 & E-G FS=9 reduced the TF and FF of paths A-C-E-G and A-C-F-G and making them critical. Lead-lag made the project less flexible and difficult to manage, in overall.

### Question #5 [15 points]

Your company needs to prepare bid price for an earth-excavating project. The amount to be excavated is 9,000 cubic yard (cy). You plan to use one 200 horsepower bulldozer. It was found on R.S. Means that the cost for labor is \$0.72 /cy and the cost for the dozer is \$1.67/cy. For this earthwork, it is estimated that a 200 horsepower bulldozer can move 500 CY per day. The project field construction overhead is \$200 per working day. Home office overhead is 10% of project direct cost.

(a) What is the estimated direct cost of this project? [4 points]

A: direct cost=9000(0.72+1.67)=\$21,510

(b) What is the indirect cost of this project and home office overhead? [5 points]

A: total duration is 9000/500=18 days (1')

Indirect cost of this project=18\*200=\$3,600 (2')

Home office overhead=21,510\*10%=\$2,151 (2')

**(c) If your company decided to have a 20% profit margin on project direct cost, what will be your bid price? [6 points]**

Profit margin =  $21,510 * 20\% = \$4,302$  (2')

Total cost =  $21,510 + 3,600 + 2,151 = \$27,261$  (2')

Bidding price =  $\$27,261 + \$4,302 = \mathbf{\$31,563}$  (2')