

1a) Engineering Contract – a legally binding understanding or agreement between parties of each other's rights & obligations. The parties to a contract are free to make any terms within limits laid down by common law and statute. Contract is binding however unjust, may be express or implied.

Element of contract: agreement (offer and acceptance); identity of intention; intention to create legal relationship; consideration

Offer and Acceptance: an offer must consist of a definite promise to be bound on specified terms. An invitation to tender is an offer to negotiate. The tender constitutes an offer. The offer and acceptance may be in writing, oral, inferred from the parties' conduct, any combination of above.

An offer may be terminated if

- revoked by offeror
- it lapses because of passage of stipulated or reasonable time
- the offeror or offeree dies
- an express or implied condition is breached
- the offeree makes a counter offer or qualifies his acceptance

1b) Ng Construction submitted a quotation to the clients, Kaolin, for building an industrial complex. Kaolin sent a letter including the following passage: We are pleased to inform you that we have accepted your quotation and therefore you may treat this letter as our official order to you. We expect to commence work on site in early January ... therefore please collaborate with other contractors to work out when you should start your own work. We would also be sending you at a later date an official contract agreement for you to sign to complete the usual formalities."

Subsequently, Kaolin purported to withdraw from the agreement. It was held at first instance, that the letter from Ng Construction was 'only a quotation and not an offer, while Kaolin's letter accepted the quotation with a qualification that Ng Construction should sign a formal contract. Therefore Ng Construction had not accepted this offer and there was therefore no contract.

However, on appeal, it was held that "on acceptance of the quotation, there was a contract binding on both parties and any subsequent disagreement between the parties on any proposal to vary the terms of the contract did not affect the contract and the contract remains valid and binding". Ng Construction's appeal was allowed.

1c) Pre-design stage

- Negligent survey of land, levels, drains, soil conditions, etc; frequently negligence at this stage produces design error in foundations. Particularly during the last four years negligence has consisted of not sufficiently checking the records in the case of made up ground.
- Negligent survey of existing building, resulting in an enormous over-expenditure in comparison with the original estimate of cost given to the client.

Design stage

- Negligent design by the Engineer or his staff. This would appear to be the most frequent type of claim, where architects have not paid sufficient regard to British Standards Institution Standards or Codes of Practice. Frequently when claims are investigated by an independent architect, it is demonstrated that the design was marginal or only just as required by the British Standards institution or a Code of Practice. Particularly prevalent during the last five years have been claims arising from inadequate consideration of the problem of damp penetration or condensation, either upward through the foundation or horizontally through the windows.
- Negligence in design, calculations, etc by consultant or specialist sub-contractors or suppliers, for whom the architect is primarily responsible to the client.
- Choice of untested materials and methods of construction: eg many cases of under floor heating and its effect on green concrete, or boarding for flat roofs without ventilation in the roof cavity. Particularly during the last five years there have been claims arising from using wall cladding as an architectural feature without paying particular attention to thermal movement or differential movement, including failure to allow for expansion joints.

Other Negligence in service

- Failure to advise client on any consents necessary from superior or adjoining landlords.
- Failure to obtain any necessary statutory consent e.g. Planning, building regulations, land commission, fire authorities and justices.
- Failure to supply information to the contractor giving rise to a claim by the contractor against the engineer's client.

Negligence in supervision

- Inadequate attendance, allowing the contractor to hide much defective work between visits. In all these cases, the decision of the Insurers to pay was based on the advice of independent architect consultants that the frequency of visits was quite inadequate.
- Failure to detect defective work both during construction and before issue of the Final Certificate.

1d)

The designer's duty of care does not extend to how the contractor carries out his work. Where there is defective workmanship, then the contractor will be liable in damages, usually for the costs of repair. Against the contractor, there will be a claim for breach of contract at the very least. It is a case of concurrent breaches of contract producing the same damage.

A designer will not be liable for negligent inspection if he fails to discover every single defect in a contractor's work. The question in every case is whether the designer exhibited that degree of skill that an ordinary competent designer would exhibit in the same circumstances and laying down rigid guidelines as to what is appropriate in general is impossible.

*East Ham Corporation v. Bernard Sunley & Sons Ltd (1966):*

As is well known, the architect is not permanently on the site but appears at intervals, it may be of a week or a fortnight, and he has, or course, to inspect the progress of the works.

When he arrives on the site there may be many very important matters with which he has to deal; the work may be getting behind-hand through labour troubles; some of the suppliers of materials or the sub-contractors may be lagging; there may be physical trouble on the site itself, such as, for example, finding an unexpected amount of underground water. All these are matters which may call for important decisions by the architect. He may, in such circumstance, think that he knows the builders sufficiently well and can rely upon them to carry out a good job; that it is more important that he should deal with urgent matters on site than he should make a minute inspection on site to see that the builder is complying with the specifications laid down by him ... it by no means follows that, in falling to discover a defect which a reasonable examination would have disclosed, in fact the architect was necessarily thereby in breach of duty to the building owner so as to be liable in an action for negligence.

It may well be that the omission of the judgment, or was a deliberately calculated risk which, in all the circumstances of the case, was reasonable and proper.

The courts do not take rigid view of the designer's duty to supervise; the theme running through the cases is that a designer's supervision must be reasonable in all the circumstances.

2ai) Not appropriate. In general, a PE shall observe the following:

-Refrain from expressing publicly an opinion on an engineering project unless he is informed of all facts:-

-Exercise restraint in critiquing work of another PE.

-He must not maliciously or recklessly injure the professional reputation of another PE.

ii) Jeffery will have conflict of interest. Jeffery should only accept money from client. He cannot take money from subcontractor. This behavior violates the basic of code of conduct & ethics which says a PE is to uphold the dignity, standing and reputation of the profession. By accepting commission, it may lead to:

- PE not discharging duty to his employer with complete fidelity
- PE may accept inferior quality material / workmanship
- Employer paying higher price for the goods / work
- PE's professional advice does not reflect best judgment
- PE feel obliged to subcom. PE may compromise subsequent work.

2bi) occupation:

- On completion of building works, owner may apply to CBC for:
  - Temporary occupation permit (TOP) or Certificate of Statutory completion (CSC).
- The building must not be occupied or used before the issuance of TOP / CSC
- TOP can be issued when building works not fully complete but in the opinion of the CBC, non completion is not detrimental to the safety and well-being of any occupant
- CSC will only be issued if building work is complete and statutory requirements of the development are complied and issued with clearance

Bii) task of AC:

- To evaluate, analyse and review the structural design in order to check on the adequacy of the structural system and elements as proposed by project PE
- To verify that the key structural elements are consistent with all the layout plans
- If design submitted is acceptable, issue a certificate to certify the effect that to the best of his knowledge, the design shows no inadequacy in the structural elements.
- AC is ineligible to serve as AC if he has financial or professional interest in the said project. He would also be deemed to be negligent if has failed to carry out the above mention task with due diligence.

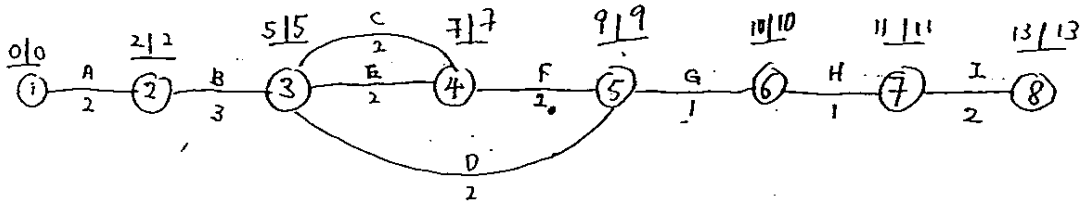
Biii) unauthorized building work: any building works carried out in contravention of BC Act's provision may be considered by CBC as unauthorized building works. The CBC may by order of writing requiring the followings to be done by the owner:

- Stop building work
- Demolition of building work
- Alteration deemed necessary to be carried out
- Do submission for application to regularize the unauthorized work

If CBC's directive are not complied, CBC can carry out whatever necessary work deemed appropriate and recover the cost from the owner.

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(a)

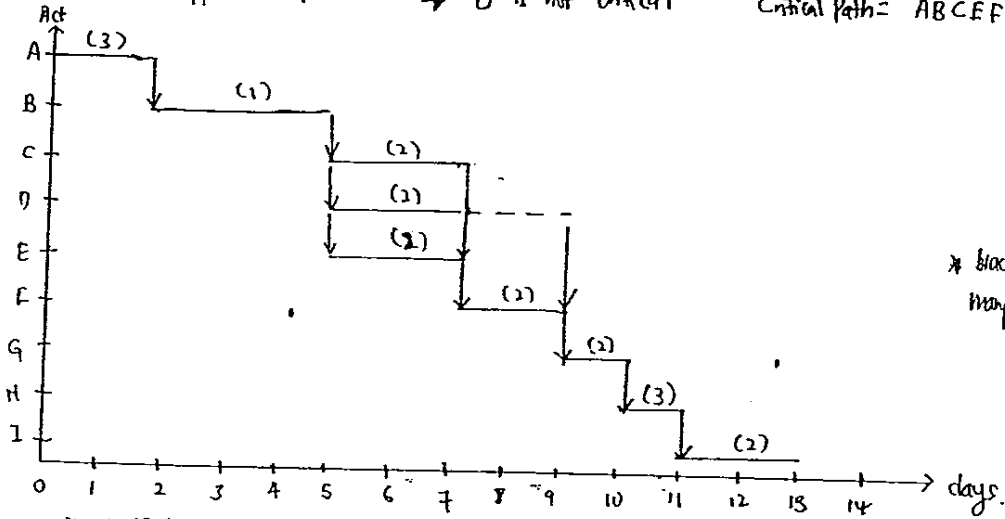


Activity D: LFT = 9

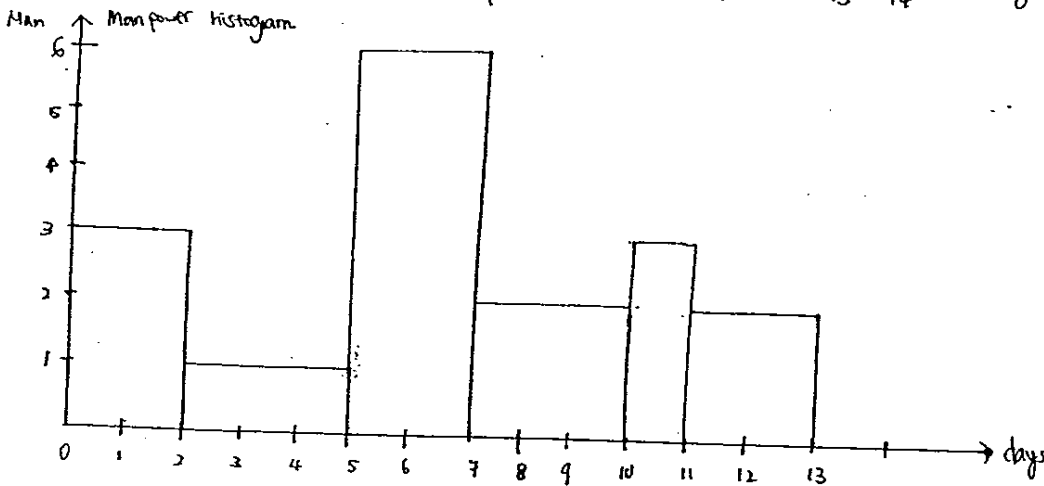
EFT = 5 + 2 = 7

TF = 9 - 7 = 2 → D is not critical

Critical Path = ABCFGHI

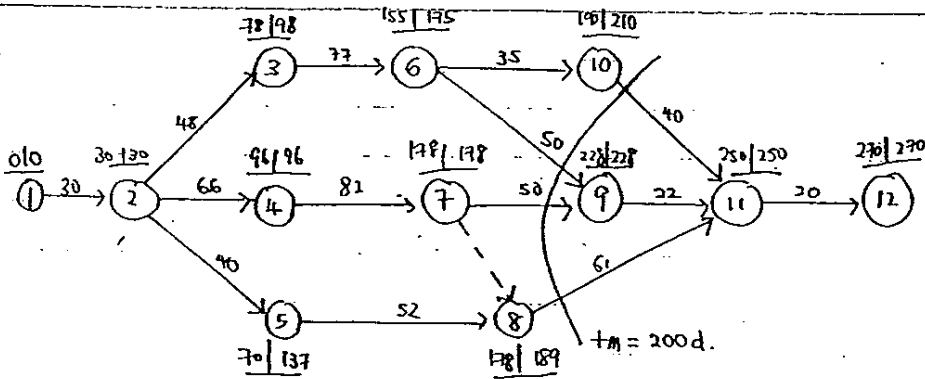


\* brackets indicate manpower needed.



Yes, U can!

(b)



Critical Path = 1-2-4-7-9-11-12

i) Activity 7-9: started on time

Time taken:  $200 - 198 = 22$  days

Time taken to complete =  $\frac{22}{40} \times 100 = 55$  days.

$\therefore$  It will exceed its duration by 5 days and since it is on the critical path, it will cause delay to the entire proj.

Activity 6-9: started on time

Time taken:  $200 - 155 = 45$  days

Time taken to complete =  $\frac{45}{80} \times 100 = 56.25$

Duration given plus float =  $228 - 155 = 73$

$\therefore$  It will not cause any delay as it has a total float of 23 days which is not exceeded.

Activity 8-11: started 2 days later than EST

Time taken:  $200 - 180 = 20$  days

Time taken to complete =  $\frac{20}{20} \times 100 = 100$  days

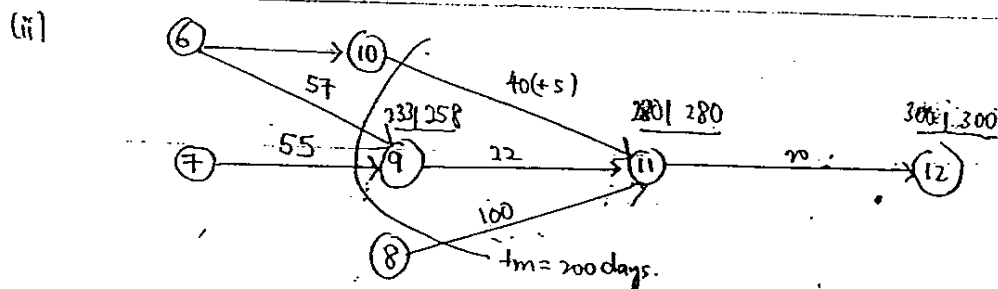
Duration given plus float =  $250 - 178 = 72$  days

$\therefore$  It will exceed its duration by 28 days as it will use up all of its float and cause delay to the entire proj.

Activity 10-11: started late

It will start 6 days later than LST, if the activity uses the specified amount of time to complete, it will cause a delay of 5 days.

Yes, I can!



(ii) The entire project is delayed by 30 days due to the delay in activity 8-11. More manpower should be supplied to 8-11.

(a)

(i) This is because the all-normal condition is the condition where the time taken to carry out the activities is at the lowest, feasible direct cost. Any condition that has durations faster/shorter than All-normal duration will incur a higher <sup>direct</sup> cost due to overtime pay, shift work and more equipment/resources usage.

(ii) The trade off for compression is that there will be no room for any errors to occur during the project as there will be no float for the events. Any mistakes made will incur great loss to the company.

(iii) The principles of cost-time planning are:

- (a) To consider only critical path activities for crashing.
- (b) To crash activities with cost slope smaller than indirect cost/time
- (c) To consider the floats of non-critical chains
- (d) Compressions are to be done in stages.
- (e) If 2 or more chains are critical, they must be compressed simultaneously by equal amounts.
- (f) Indirect cost (savings) > Direct cost (incurred) when one unit of time is crashed.

Yes, U can!

(b) Indirect cost = \$1800 per day

Before crashing: 1-2-3-6-10 is critical path.  
2-4-7-8-10 has 2 days float.  
2-5 has 10 days float / 8-9-10 has 6 days float.  
5-9 has 16 days float

① First crash will be 2 days:

- Crash activities must be indirect > direct  $\rightarrow$  1-2 is eliminated
- 6-10 has lowest direct cost of \$250. (Chosen)
- $\therefore$  Incurred direct cost =  $\$250 \times 2 = \$500$
- Reduced indirect cost =  $\$1800 \times 2 = \$3600$ .
- Project duration = 13 days

After 1st crash: 1-2-3-6-10  
& 1-2-4-7-8-10 } critical paths.  
2-5 has 8 days float.  
8-9 has 4 days float. 5-9 has 14 days float

② Second crash will be 4 days:

- 6-10 will be crashed 2 days
  - 3-6 will be crashed 2 days
  - 8-10 will be crashed 2 days
  - 7-8 will be crashed 2 days
- 1-2-3-6-10 path.  
2-4-7-8-10 path.

$$\text{Incurred direct cost} = (250)(2) + 700(2) + 150(2) + 800(2) = \$3800$$

$$\text{Reduced indirect cost} = (\$1800)(4) = \$7200$$

$$\text{Project duration} = 89 \text{ days.}$$

③ Third crash will be 4 days: as since only 2-5-9 has 4 days float.

- 3-6 will be crashed 4 days
- 7-8 crashed 1 day; 4-7 crashed 2 day; 2-4 crashed 1 day

$$\rightarrow \text{Incurred direct cost} = 700(4) + 800 + 750(2) + 1100 = \$6200$$

$$\text{Reduced indirect cost} = 1800(4) = \$7200$$

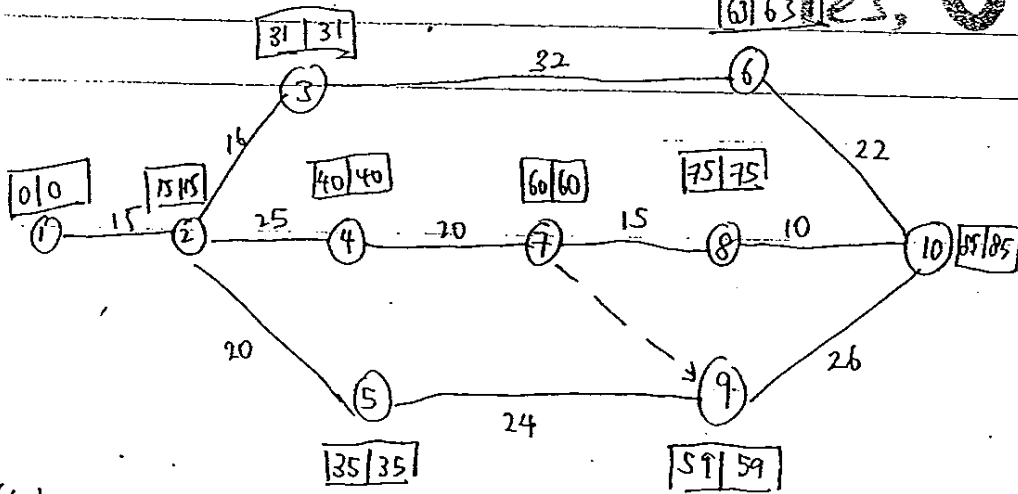
$$\text{Project duration} = 86 \text{ days.}$$

$\therefore$  All floats are used up.

(next page)  $\rightarrow$



Yes, I can!



Total:

Time saved = 10 days.

$$\text{Amount saved} = 10(1800) - (500 + 3800 + 6200) = \$7500$$

$$\text{Total project cost after crash} = \$1100,000 - \$7500 = \$1092,500$$

Although the saving is little when compared to total cost, time is much more valuable in projects and 10 days is about 10% of the project time.

Good Luck 🌟