MARKS

Question 1(Dr Fred Bosché)

a)
The Network Precedence Diagram is shown below. The Critical Path is highlighted.

A 50% answer may have a sequentially logical Network Precedence Diagram, but fails to achieve the expected (shortest) completion time (27 weeks).
A good answer should have a correct Network Precedence Diagram (i.e. ES, EF, EF, LF are mainly correct for all activities), but may have some local errors or may lack the critical path.
A perfect answer will have everything correct.

18
(-4 for each major error;
-2 for each minor error)

(b)
The early-start Gantt chart is shown below. The Critical Path is highlighted with crosses.

A 50% answer may have a sequentially logical Gantt chart, but fails to achieve the expected (shortest) completion time (27 weeks).
A good answer should have a correct Gantt chart (i.e. start and end dates are correct for all activities), but may lack the precedence relationships and/or the critical path.
A perfect answer will further include the precedence relationships and critical path.

8
(-3 for each error.
(a) is the baseline. So, errors in (a) shouldn't be penalised again here)

(c)
The table under the Gantt chart summarizes the resource requirements based on the initial programme. It appears that the Concrete Crew (CC) and Crane (C) are both **overallocated** at two similar occasions.
The approach to solve the overallocation is different for the two cases to be addressed:

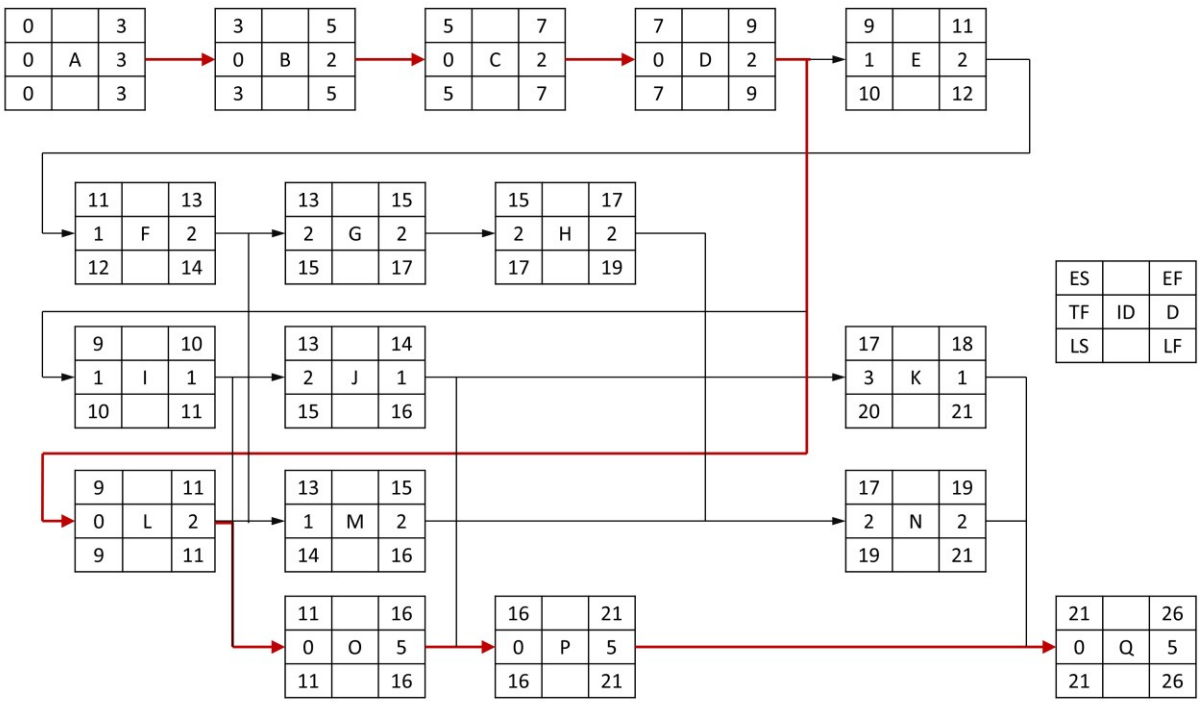
(i) This requires delaying the Columns Floor 1 (E) and Slab Floor 2 (F) by 1 day, i.e. until the Stairs 0-1 (I) is completed, and delay Columns Floor 2 (G) and Slab Roof (H) by 2 days, i.e. until Stairs 1-2 (J) is completed (note that J is already delayed by 1 day due to the previous delay of E and F. This solution uses the float within the project without delaying the project completion. But, note that the impact of this is that virtually all activities are now critical. See last graph showing solution.

(ii) The solution above shows that it is possible to level the Concrete Crew (CC) and Crane (C) resources without delaying the completion of the whole project. Therefore, it is applicable to this case as well.

A good answer should identify correct overallocation of the concrete crew and crane. The solutions proposed for the two cases should be fair, but may not be optimal.
A perfect answer will actually identify that the same solution applies to both cases.

Note: marking should be done independently from the answer given in (a) and (b). If the answer for (a) and/or (b0 is different from the one expected, different overallocations may be identified by the student for which different but nonetheless appropriate solutions must be provided. However, if no overallocation is found from the answer for (a), then the students can only receive full marks (maximum 6 marks can be awarded).

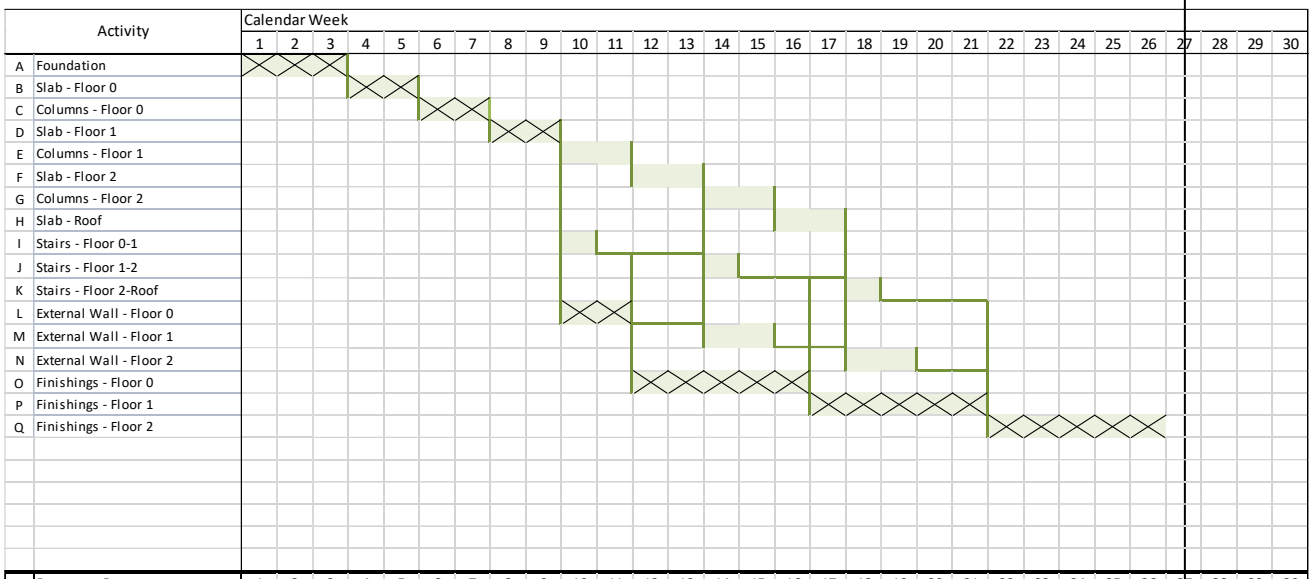
2 marks for correct resource allocation and identification of overallocation;
5 marks for (i) and (ii) each.
For those, 4-5 marks are given if the answer is really convincing and achieve similar results as those presented above; lower marks should be given otherwise.



MARKING GUIDE

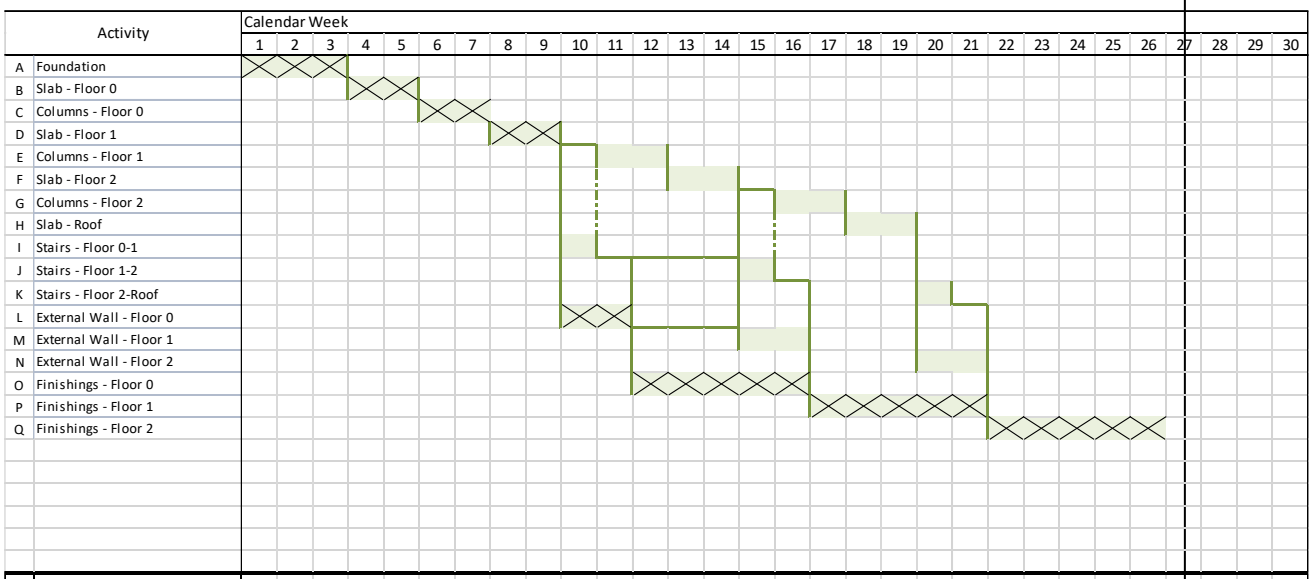
EXAM TITLE: Engineering Project Management Dec 19

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	Activity	Calendar Week																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	Foundation																														
B	Slab - Floor 0																														
C	Columns - Floor 0																														
D	Slab - Floor 1																														
E	Columns - Floor 1																														
F	Slab - Floor 2																														
G	Columns - Floor 2																														
H	Slab - Roof																														
I	Stairs - Floor 0-1																														
J	Stairs - Floor 1-2																														
K	Stairs - Floor 2-Roof																														
L	External Wall - Floor 0																														
M	External Wall - Floor 1																														
N	External Wall - Floor 2																														
O	Finishings - Floor 0																														
P	Finishings - Floor 1																														
Q	Finishings - Floor 2																														

	Resource Req.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	CC	1	1	1	1	1	1	1	1	1	2	1	1	1	2	1	1	1	1												
	C	1	1	1	1	1	1	1	1	1	2	1	1	1	2	1	1	1	1												
	EWC										1	1			1	1			1	1											
	FC												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				



	Activity	Calendar Week																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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F	Slab - Floor 2																														
G	Columns - Floor 2																														
H	Slab - Roof																														
I	Stairs - Floor 0-1																														
J	Stairs - Floor 1-2																														
K	Stairs - Floor 2-Roof																														
L	External Wall - Floor 0																														
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	Resource Req.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	CC	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1												
	C	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1												
	EWC										1	1			1	1			1	1											
	FC												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				

Question 2 (Simon Smith) **This is a freeform question with many possible formats for an answer. The best will be presented clearly and effectively and provide a depth of answer commensurate with the marks available. Thin, single line answers will not suffice and will be marked accordingly. Answers which are impenetrable and difficult to read, through poor handwriting or unthinkingly laid out on the page – say with a long block of unstructured text – will also be marked low. Answers which merely reiterate the examples and theory given in the note of in the lectures will receive average marks. Those who go to the effort of providing examples to support their answers will see enhanced marks.**

a) The initial stage is *Demand*. It is important for a successful launch of a project and enables the ability to judge a project's success or otherwise. The following points must be made:

i. The responsible party is the Promoter (aka Client, owner, employer)
ii. The consequences for getting this wrong are many and varied and the greater majority of the marks for this question come from this part. All marks are enhanced if examples are used to support answers. Points made may include:
    - Not being able to make a correct decision on whether to go ahead with the project or not.
    - Getting the capacity wrong, which will lead to incorrect estimates of time and cost
    - Project scope being incorrectly unidentified and defined leading to poor appointments of design teams
    - Not being able to provide suitable performance attributes that the project can be measured against
    - Providing a project that is not fit for purpose; or providing a project that is not actually needed
iii. Stakeholders will be those who can correctly demonstrate the need for a project and thus are necessary for the determination of success factors.

10 marks

b) This is a small project with usually no need to consider the decommissioning of the facility. While there may be considerations made at design stage for the eventual refurbishment, reuse or demolition; the project can be effectively held to be complete once handed over to the client.

However, as long as the student demonstrates full understanding of the nature of this project and its difference to that in part c) then any reasonable answers will be allowed.

i. It is important to realise that the completion of the project is when the objectives are met. The owners objectives are for the delivery of a project that meets their needs
ii. The contractor considers the project complete when they have handed it over to the owner and have been paid all that is due to them

8 Marks

c)

i. This project is intended to draw parallels with the Brent Spar example shown in the lectures and so the project should not be held to be complete until the Decommissioning stage is reached.

ii. The Decommissioning plan should be fully prepared for at the planning and design stage of the project. These should be an understanding of how the project might be removed both safely and without detriment to the marine biology of the Gulf of Mexico. Full details are not expected.

iii. Students should provide some possible reactions if this is not done such as those experienced by Shell with Brent Spar – i.e. adverse public reaction, protests, increased cost of actual decommissioning etc.

12 marks

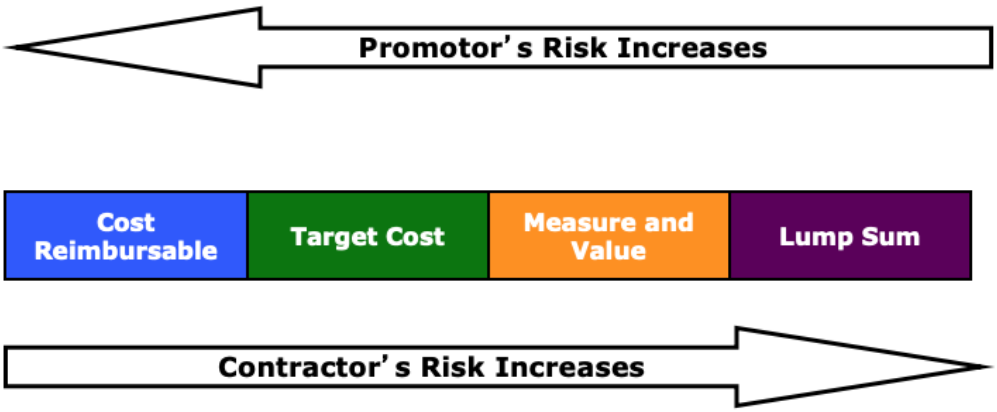
Question 3 (Simon Smith)

a)

i. The Contractor is paid for the work actually done at ***pre-agreed unit rates***. In this type of contract it is important that the items in a *Schedule of Rates* or the Priced *Bill of Quantities* cover the whole of the work and that the method of measurement of quantities is clearly defined. Schedule of Rates Contracts are generally used where the nature and extent of the work can be accurately defined but the quantity of work cannot.

ii. Based on the setting of a probable (or target) cost for the work. The target cost will subsequently be adjusted for major changes in the work and cost inflation. The contractor's actual costs are monitored and reimbursed as in a cost-reimbursable contract. Any difference between actual cost and target cost is shared in a specified way between the promoter and the contractor. The sharing is usually set as a percentage ratio e.g. 80:20 with different allocation for savings and excess costs. Both promoter and contractor must be satisfied with the target estimate that should have a reasonable maximum and minimum cost for the work. Usually, as with cost reimbursement, there is a separate Fee for overheads and profit.

The discussion on risk would be expected to be accompanied by a diagram that demonstrates the distribution, such as:



It is also expected that the discussion includes an understanding of why risks may arise and what their consequences may be, again using examples.

10 marks

Question 3 cont.

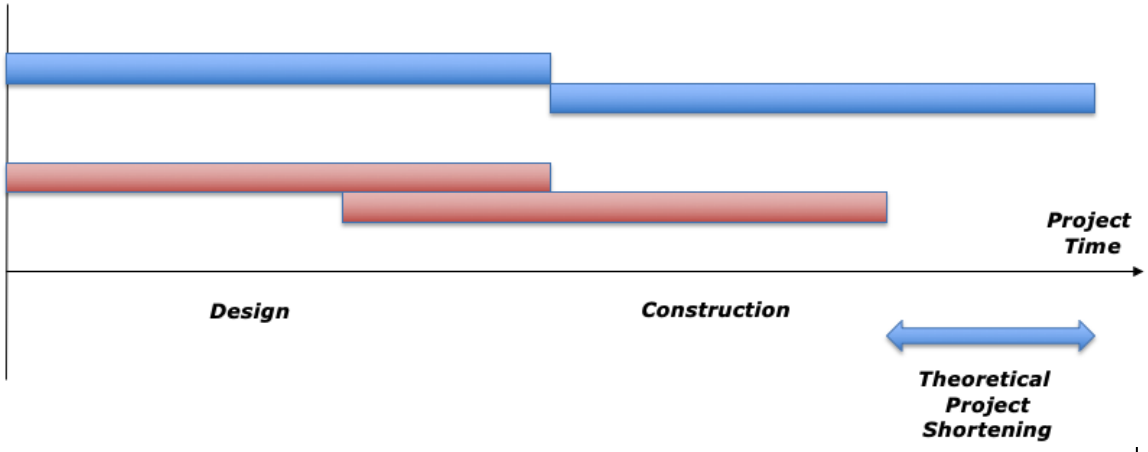
b)

i. The Contractor is reimbursed the actual costs incurred in carrying out the work under the Contract plus a fee to cover overhead costs and profit. The *fee* can be one of the following:
- a fixed sum.
- a fixed sum with a profit-sharing or a bonus arrangement.
- a fixed fee with a sliding-scale adjustment.
- a percentage of the costs.

A cost reimbursement contract may also have a guaranteed ceiling price nominated.

ii. The clear disadvantages here are that there is no incentive for the contractor to reduce the cost of their work and work efficiently; and also that the promoter retains all of the risk for uncertainties. Additionally it requires the contractor's cost accounts to be open to the promoter.

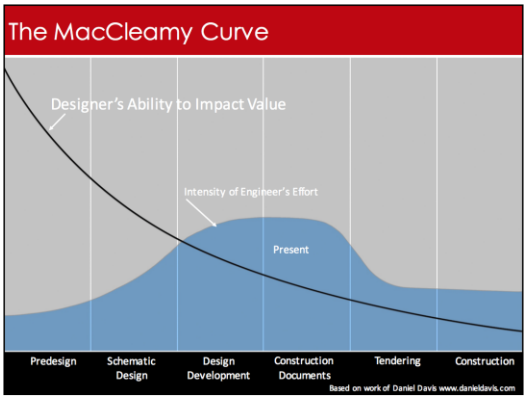
iii. The main use for a cost reimbursement contract is where the nature, extent or quantity of the work cannot be accurately defined when negotiating the Contract. As discussed in class there are also benefits in allowing the construction to start without the design being complete (and why is this? Because a complete design is needed to allow a full cost estimate to be made which is needed for all other payment methods.) This will allow a theoretical shortening of the project time. The situation is summarised by the following diagram which good students will provide:



12 marks

Question 3 cont.

c)



i.

ii. The MacLeamy curve (miss-spelled above) clearly shows that the designer's ability to impart value diminishes as the project proceeds. Better students will indicate why this is – that is, once work has been done, changes to this work will cost more money and thus the influence of the designer on the project's value diminishes as more and more work is done. In other words, any changes the designer may make towards the end of the project will cost more to implement and thus the value of the change is reduced. This leads to the point of the question, which is why changes may be made? Yes the designer may suggest changes but as she knows this would not impart value they tend not to instigate change – but the client is often unaware of this and thus often will request changes without understanding the impact of this. Ultimately, therefore, the client must (a) be able to approve early designs and (b) not ask for late changes if they are to have a cost-effective project.

8 marks

END OF PAPER