Institute of Systems Science
National University of Singapore

MASTER OF TECHNOLOGY IN SOFTWARE ENGINEERING

Self Assessment Examination 2011

Subject: *Software Project Management*

Sample Solutions to Self-Assessment Examination Questions

SECTION A

Question 1 [30 Marks]

a. *(16 Marks)*

#	Subcontracting Risk Items	Strategies to Address Risk
1.	The project schedule is dependent to a significant extent on the ability of the subcontractors to deliver on time.	▪ Insert appropriate penalty clauses in subcontracts ▪ Insist that subcontractors submit detailed plans. ▪ Undertake regular progress monitoring with each subcontractor.
2.	The project has a fixed budget (a fixed price contract has been signed), but contracts with the subcontractors are not yet agreed. If the financial agreements with the contractors can not be kept within acceptable limits, there is a risk that the project will overspend.	▪ Determine a detailed estimate of the cost of the work to be done by Critical Systems. ▪ Negotiate to minimise the price of each subcontract. ▪ If necessary, or if time permits, consider alternative vendors. ▪ If the cost of the subcontracts is likely to lead to a less than acceptable profit margin for Critical Systems, then this should be conveyed to the senior management of Critical Systems ie: it should not be a surprise to them.
3.	Critical Systems has chosen to use overseas contractors (HazardData and Emergency Software Systems AG). Both are thousands of miles away and one is from non-English speaking country. Hence risks might be expected concerning miscommunication of requirements, coordination and monitoring.	▪ Clearly define the technical requirements for each subcontract. ▪ Formally agree requirements. ▪ Require subcontractors to provide detailed plans and progress reports. ▪ Require overseas subcontractors to attend at least one progress review in Singapore every three months.
4.	Data Entry Services are unknown to Critical Systems, and have been mainly selected for their *cheapness* rather than for the quality of their services. There would appear to be a reasonable risk that their work	▪ Set more stringent requirements on this subcontractor ie: ensure that a very detailed specification of the required data is provided, and ensure that frequent progress reporting and monitoring takes place.

#	Subcontracting Risk Items	Strategies to Address Risk
	will not meet expectations.	▪ Perform rigorous acceptance testing of the supplied data, including reviews/tests of samples of the work in progress. ▪ Short list a *standby* company in case Data Entry Services can not perform.
5.	The APIs delivered by two of the subcontractors (DigiMap and HazardData) will be used by Critical Systems in their application development work. However, they are currently unspecified and will only be delivered in the 2nd year of the project. This will put schedule pressure on Critical Systems. There is also a possibility that the APIs will not perform as expected which would lead to additional work by the Critical Systems developers.	▪ Try to negotiate for the APIs to be delivered prior to the delivery of the data. ▪ Agree on a detailed specification of the required APIs as early as possible. ▪ Agree on a detailed interface specification for each API so that code can be written even if the *actual* APIs are not available. ▪ Agree on testing requirements, and insist that test results are made a required deliverable from each subcontractor.
6.	Critical Systems are responsible for producing the design documentation for the whole software system. However, parts of the software must be designed and developed by the subcontractors (Critical Systems would not be able to design these parts as they relate to the proprietary data or modeling software of these vendors). Hence there is some risk associated with the completeness of the specification, and hence its acceptability to the client.	▪ Require that the subcontractors that are developing software provide design specifications, according to an agreed format, for their software. ▪ Hold joint reviews attended by Critical Systems, the client representatives and the subcontractors.
7.	Critical Systems are responsible for producing the user, operations and maintenance documentation. However, not all of the hardware and software is provided by themselves. Hence, there is a risk	▪ Require that each subcontractor, if appropriate, provides documentation according to an agreed format

#	Subcontracting Risk Items	Strategies to Address Risk
	that they may not be capable of providing adequate documentation for the subcontracted items.	
8.	Critical Systems are responsible for obtaining overall acceptance of the system. However, there is a risk that the system might be rejected by client due to their displeasure with the components provided by the subcontractors.	▪ Agree contractual requirements for acceptance with each subcontractor. ▪ Require the subcontractors to participate in defining the project's acceptance criteria and acceptance test plan. ▪ Agree testing requirements for each subcontractor, and insist that test results are made a required deliverable from each subcontractor. ▪ Agree requirement on each subcontractor to support acceptance testing and the *running-in* period.

Marking Scheme:
- *2 marks for each valid risk and risk resolution strategy.*
- *Maximum: 16 marks.*

b. *(10 Marks)*

See Figure 1.

Marking Scheme:
- *Add 1 mark for identifying each of the 4 main teams: Software Dev, Data, Installation & Maintenance and Supporting Services.*
- *Add 0.5 marks for identifying each of the 12 sub-teams under an appropriate main team.*
- *Subtract 1 mark for each missing subcontractor/vendor.*
- *Subtract 0.5 marks for each missing internal aspect of the project.*
- *Maximum: 10 marks.*

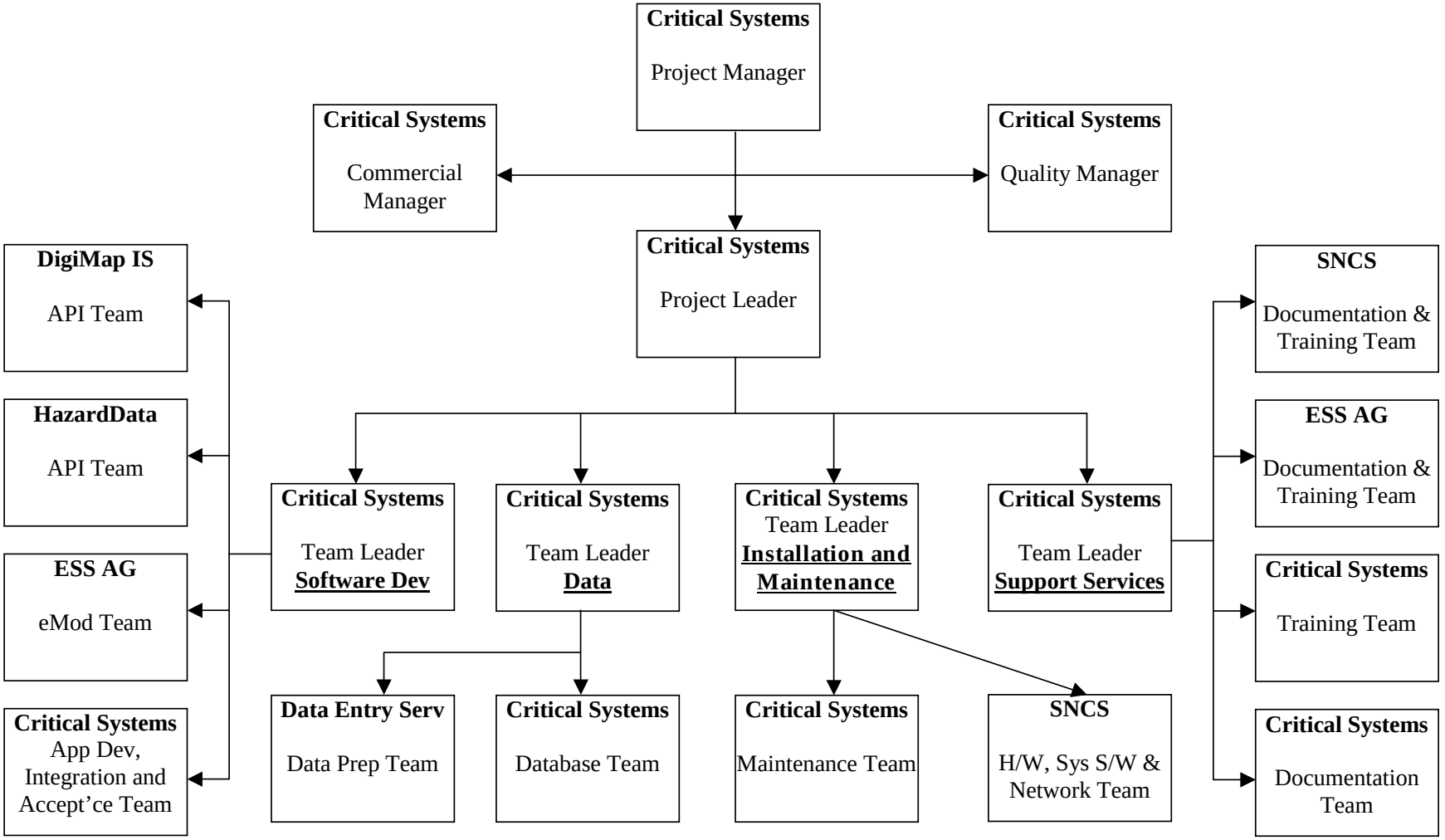
c. *(4 Marks)*

1.	Undertake a Requirement Review on the User Requirements Specification (which already exists) to check for adequacy, and revise if necessary.
2.	Develop technical prototypes explore possible architecture and technology options to achieve the requirement.
3.	Define the selected architecture/technology and the resulting software structure in the Software Design Specification.
4.	Undertake a Design Review to check for adequacy, and revise if necessary.
5.	Perform system and integration tests that would include tests specifically designed to verify the performance requirements. These would be planned using the System Test Plan and Integration and Installation Test Plan
6.	Review the test results, as documented in the System Test Results Document and the Integration and Installation Test Results Document, to confirm that the requirement performance requirements have been achieved, and to initiate corrective action if necessary.
7.	Perform acceptance testing, as planned in the Acceptance Test Plan, to validate the performance requirements against pre-defined scenarios defined by the users, and to initiate corrective action if necessary.
8.	Conduct the *Running-In* of the system to further validate the performance requirements against situations that are met in day-to-day usage over a three month period, and to initiate corrective action if necessary.

Marking Scheme:

- *Add 0.25 marks for each valid activity*
- *Add 0.25 marks for each valid reference to the correct deliverables.*
- *Subtract 1 mark if no activities before coding are mentioned.*
- *Maximum: 4 marks.*

Figure 1: Solution to Question 1 (b)



SECTION B

Question 2 [25 Marks]

a. **Current Progress**. The current end-day for the project based on current work practices and current performance would be day 40 of the project, 5 calendar days late. The Tracking Gantt chart in figure 2 shows the actual progress and predicted current end of the project. It allows for task 9 slipping by one day, and acceptance being delayed by one week.

(5 Marks)

b. The major problems faced by the project are:

- The dramatic changes to requirements suggested by the MD of Lee Realty. These are very different from the original requirements agreed with Lee Realty.
- The poor quality of the user interface software. It appears from the code modules that this is both incorrect and faulty, and more seriously does not implement the original requirements.
- The delay of one week in Lee Realty staff being available to carry out acceptance tests *(in reality this is a blessing in disguise).*

(5 Marks)

c. It is proposed therefore to adopt the following measures to combat the problems identified above:

- The major changes in requirements cannot be incorporated into the current project. They are currently too vague and, based on the brief description that was given by the Lee Realty MD, probably impossible to implement within the current timescale. ATS probably have a good case for saying that they should continue to develop the system that they were originally contracted for, and should expect to be paid for this system. However, in order to maintain good relations with the customer (and also to ensure that the current system can be enhanced) it is proposed that some work be performed to gather the requirements for the Internet system that the Lee Realty MD is proposing. It is therefore proposed to carry out a new task: *Task 11: Research new requirements*, which would take the following resources:

  Project Leader: 1d

  This will be included in the project budget, and the output from the task would be a short memo summarizing the new requirements.

- The more serious problem is the poor quality of the user interface module. The walkthrough revealed that the software does not match

the requirements, is faulty and is not documented. It is possible that it could be modified, but without the presence of the PR2 (who is off sick until day 30) it is unlikely that anything positive would be achieved. It is therefore proposed that the user interface module is completely redeveloped, with a new task: *Task 4A: Re-code User Interface*. This would involve completely rebuilding this software, and would take the following resources:

Project Leader:	2d
PR1:	4d

There would also be a need to walkthrough the completed UI software, so another new task: *Task 6A: Walkthrough Revised UI software* would be performed. This would take the following resources:

Project Leader:	0.5d
PR1:	1d

This makes allowance for the possibility that further re-work may be necessary on this software.

- It is expected that PR2 would perform his original tasks after rejoining on day 30.

- As mentioned the delay of one week in Lee Realty staff being available to carry out acceptance tests is actually a benefit. This extra week can be used to perform *Task 4A: Re-code User Interface.*

(5 Marks)

d. Given these measures the revised WBS and effort estimates for the project are shown below:

(5 marks)

Table 1: Revised WBS and estimates for the Lee Realty Project

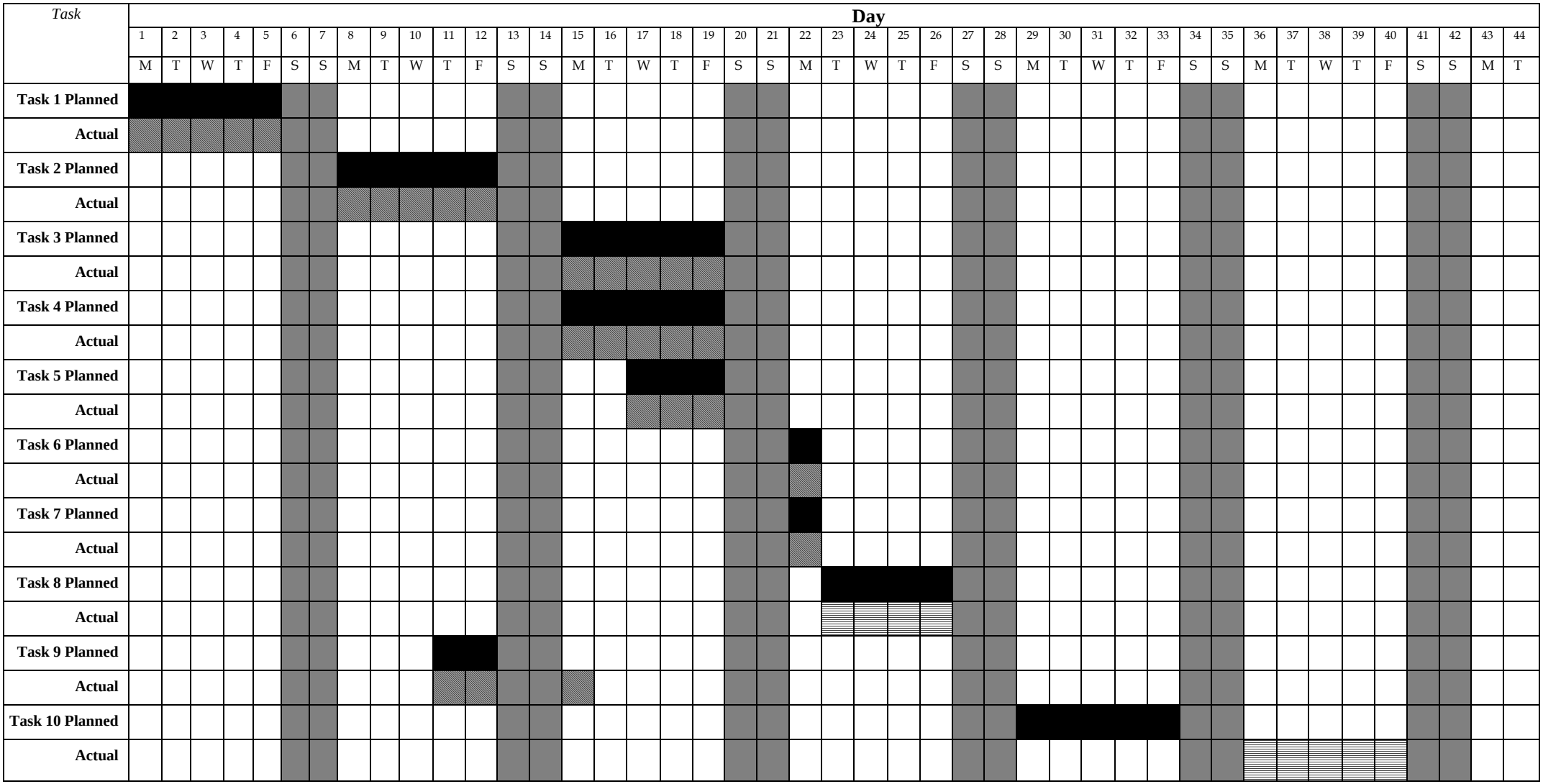
Task	***Individual Effort***			
	PL	***PR1***	***PR2***	***SE***
Task 1: RA	5			
Task 2: SD	3	5	-	
Task 3: DI	1	5	-	
Task 4: CU		-	4	
Task 5: HI	3	-	-	3
Task 6: WD	1			-
Task 7: WU		1		-
Task 8: SI	2	4	4	-
Task 9: PA	3	-	-	-
Task 10: DS	-	5	5	-
Task 11	1			
Task 4A	2	4		
Task 6A	0.5	1		
TOTAL				
Costs per day	1000	500	500	500
Total costs	21500	12500	6500	1500

Total Labour Costs:	42000
Total hardware/utility costs:	18000
Contingency: (a reduction of $5000)	1000
Profit:	9000
TOTAL (S$)	70000

The extra cost of $5000 can be absorbed within the project contingency budget of $6000. However, this would use up the entire contingency budget. Hence, efforts should be made to obtain further contingency funds from senior management. The new project plan is shown below in figure 3.

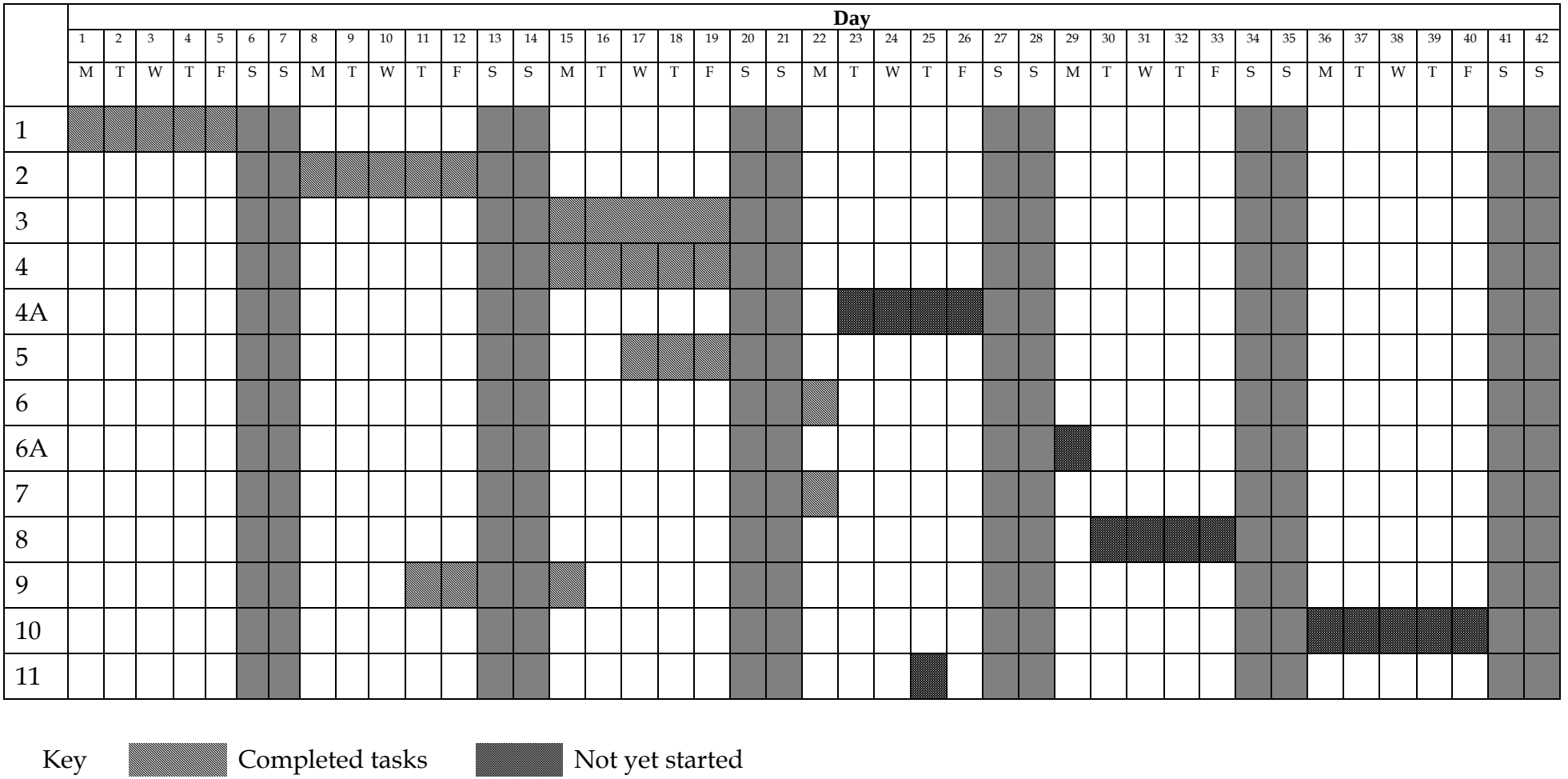
(5 Marks)

Figure 2: Current Progress



Key: Planned Completed Yet to be started

Figure 3: Proposed New Plan



Question 3 [20 Marks]

a. *(5 Marks)*

For the on-line Loan application facility project we note that:

- The most similar project is D; it is closest in size and has the same technology familiarity as on-line Loan application.
- To account for difference in size; assume effort goes up linearly with size which implies that adjustment for size alone is 1.25.
- To account for difference in Application Domain familiarity, note that project A and B differed in both size and Application Domain familiarity.
  - When you look at the effect of size project A is bigger than Project B by 1.33.
  - You note that the difference between project A and project B due to Application Domain Familiarity alone is 1.20.
  - This implies that as X has Low application domain familiarity, and project C has high application domain familiarity then a further effort adjustment must be made of 20%.
- This means that the final estimate of effort will be = 100* 1.2* 1.25
  = 150.00 man-days

b. *(5 Marks)*

Given a team size of 3, then an estimate of duration for the project will = 150/3
= 50 days

The duration of installation and training = 5 + 5
= 10 days

So total duration of development and installation and training = 60.days
= 3 months

Given the average cost of IT staff =$500 day

Total Cost of Software Development = $75000

The costs per quarter for the project are given overleaf in Table 2.

c. *(5 Marks)*

The best case/worst case benefits are given overleaf in Table 1.

Table 2: Costs & Benefits of the On-Line Loan Application Project

	Quarter in which cost /benefits are realized								TOTAL
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	
Costs									
Software Development	75000.0								
Hardware Purchase	10000.0								
Software Installation	2500.0								
Training	7500.0								
Software Maintenance	312.5	1875.0	1875.0	1875.0	1875.0	1875.0	1875.0	1875.0	
Hardware/Software Utility Maintenance	41.7	250.0	250.0	250.0	250.0	250.0	250.0	250.0	
Total costs	**95354.2**	**2125.0**	**2125.0**	**2125.0**	**2125.0**	**2125.0**	**2125.0**	**2125.0**	**110229.2**
Best Case Benefits		25000.0	31250.0	39062.5	48828.1	61035.2	76293.9	95367.4	376837.2
Worst Case Benefits		15000.0	17250.0	19837.5	22813.1	26235.1	30170.4	34695.9	166002.0

It can be shown from the above table that:

- The benefits index given the best case benefits scenario = 341.9%
- The benefits index given the worst case benefits scenario = 150.6%

d. *(5 Marks)*

Terms of Reference

Asia Pacific Bank has been exploring the possibility of developing an on-line Loan application facility that can be used by customers to apply for and obtain a loan of up to $50,000. The *Asia Pacific Bank* Board of directors commissioned a study to determine whether the project would be financially viable.

Details of the Study

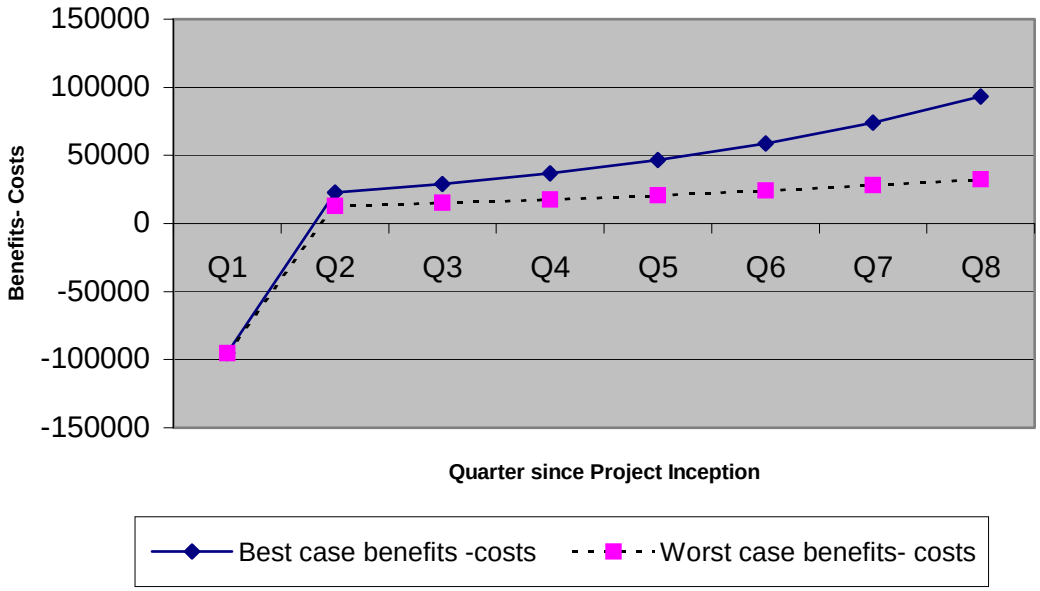
The study assessed:

- The costs of developing and maintaining the on-line Loan application.
- The benefits accruing to the on-line Loan application, both a best case and worst case analysis were calculated.

The results are shown below in the table and figure:

	$	Benefits Index
Project Cost (over 2 years following project inception)	110229.	-
Project Benefits (over 2 years following project inception)		
• **Best Case**	376837.	341.9%
• **Worst Case**	166002.	150.6%

Cash flow for On-Line Loan Application Project



Recommendation:

To continue with the on-line Loan application project as:

- Although the worst case does not achieve the 200% benefits index desired by management, the Best case exceeds this index by 141.9 %.
- If we take the "average" case to be the mean of the best case and worst case then the benefits index would be 246.2%, exceeding the200% benefits index desired by management.
- Furthermore this project would secure Asia Pacific Banks position in the Internet banking sector, allowing for future business expansion later.