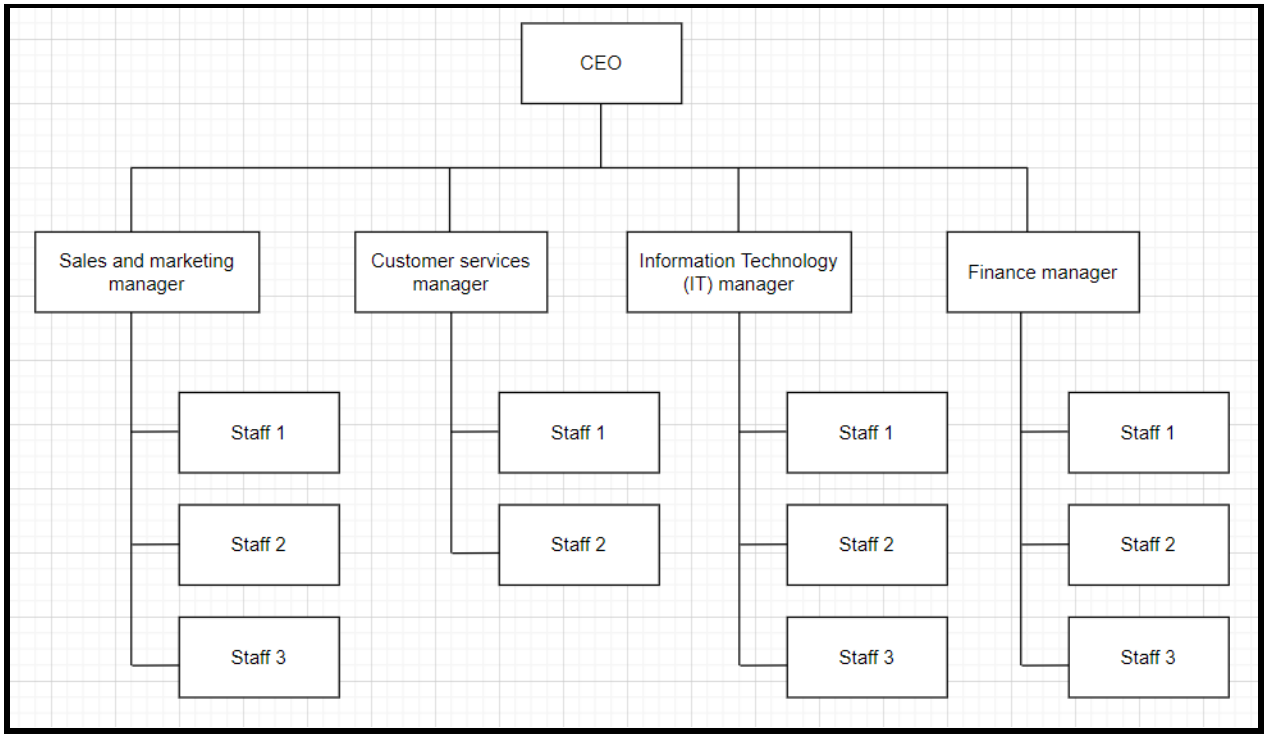
Tutorial 1 : Project Management Concept

Question 1

Syntax Tech Company provides software consultancy services to business clients, it focuses on selling accounting software. The company consists of 4 different departments: s*ales and marketing, customer services, information technology (IT) and finance*. Each staff member will be assigned to a department according to his or her area of specialization and expertise. The sales and marketing department consists of 3 staff, 2 staff work in the customer service department, while 3 staff work in the finance department and 3 experienced staff work in the IT department. Each department is *supervised by a functional manager and each functional manager in turn reports to the Chief Executive Officer (CEO)*.

(a) Construct an organizational structure diagram for the Syntax Tech Company.

Functional Organizational Structure:



(b) Explain TWO (2) advantages of this organizational structure from the perspective of an employee.

- **Clear definition of authority -** The staff has a clear reporting relationship, they know who they need to report to. For example, IT staff only need to report to IT managers but not multiple managers.
- **Eliminates duplication of work** - Each staff and department has their own specialization of job scopes/ functional area.

- **Encourage specialization** - For example, IT staff focus on the job related to IT matters only.
- **Clear career paths** - Different jobs require a different set of knowledge, skills and attitudes. Due to the job specialization practices, the staff will only need to specialize in certain specialized areas. For example, the staff in IT departments only perform the job related to IT matters only such as providing technical support.

Advantages of project organizational structure

- **Unity of command** - This is because the whole team is dedicated to 1 project and they are all responsible for/reporting to a project manager. Thus, it can reduce staff's confusion as it will only have one project manager to give them instructions on how to complete the task.
- **Highly responsive to project's objectives/ customer needs** - This is because the whole team is focusing on the project objectives to achieve it. For example, the whole team will be involved together in requirements elicitation, system analysis, system design and system development process to achieve the project goal and meet the customer requirements.

Question 2

You are a project manager of an online education management system developed for a local college. After communicating with the customer for collecting requirements, the following scope is defined: the system will be used to manage communication between lecturer and students, uploading and downloading learning materials (such as tutorial questions, lecture notes, assignments specifications), making announcements, and assessing students' assignments.

Construct a ***Work Breakdown Structure (WBS)*** for the online education management system using an outline numbering format. Assume that you have chosen the ***Waterfall software process model***.

1. System Planning
   1.1 Define project scope
      1.1.1 Define project objectives
      1.1.2 Define expected benefits of the new system
      1.1.3 Define constraints, assumption and dependencies of the new system
      1.1.1 Define stakeholder requirements
   1.2 Preliminary Investigation

- 1.2.1 Technical feasibility
- 1.2.2 Economical feasibility
- 1.2.3 Operational feasibility
- 1.3 Define the project schedule

2. System Analysis
   - 2.1 Evaluate and analyse existing system
   - 2.2 Perform fact gathering
     - 2.2.1 Interview
     - 2.2.2 Observe the current college learning processes
     - 2.2.3 Distribute questionnaires to staff, lecturers, and students
   - 2.3 Perform data analysis
     - 2.3.1 Data flow diagram
     - 2.3.2 Decision tree
   - 2.4 Define requirements
     - 2.4.1 Identify requirements
     - 2.4.2 Identify conflicts
     - 2.4.3 Identify possible improvements
     - 2.4.4 Propose possible solutions
     - 2.4.5 Agree on requirements

3. System Design
   - 3.1 Define input and output medium
   - 3.2 UML diagram
   - 3.3 Database design with ERD
   - 3.4 User interface design

4. System Implementation
   - 4.1 Coding and Development
     - 4.1.1 User Module
     - 4.1.2 Announcement Module
     - 4.1.3 Course Module
     - 4.1.4 Student Assessment Module
   - 4.2 Progress Reporting
   - 4.3 Testing
     - 4.3.1 Unit Testing
     - 4.3.2 System Testing
     - 4.3.3 Performance Testing
     - 4.3.4 User Acceptance Testing
   - 4.4 Equipment, File, System Conversion
   - 4.5 User Training

5. Closing

5.1 Final Project Report
5.2 Final Project Presentation
5.3 Project Completed

Question 3

T-Shirts2U is a small company which supplies and manufactures customized t-shirts. Since 2016, this company has experienced a tremendous increase in its orders. However, the current system which is partially automated is unable to keep up to pace its growth: it is unable to keep track of the orders efficiently, it is unable to provide accurate information to the management on which item promotions are more profitable and there have been mistakes in some of the order fulfillments. Assume that you have been contracted by T-Shirts2U to develop a new ordering system for the company that will solve the stated problems.

Discuss **TWO (2)** important factors that should be considered to assure the success of the above project. Give reasons to support your answer.

Top management support

We need to get adequate top management support for example support of financial resources to ensure we have adequate funding for the project to buy the necessary hardware, and software, to pay salary and consultation fees, this also includes the support from other departments for example, support from sales and marketing department to promote newly developed software.

Good project planning and controlling process

This include adequate communication plan, proper project planning, accurate estimation of time and budgets as well as project scheduling and involvement of the end users, for examples the information about scope, objectives, responsibility and acceptance criteria must be documented and well communicated early in the stages of project and the project team should encourages user involvement to mold the systems design.

Good leadership and organizing skills

This include the good project manager with a good leadership skills, does not neglect of systems approach in the project life cycle, and proper use of project management techniques such that the project manager is able to control conflicts occurring between the project team members and stakeholders, who can allocate and organize the required hardware, software, other resources and facilities needed for the project.

Question 4

You are a project manager in a global project with a virtual team consisting of employees from Asian Countries. Identify **TWO (2)** possible challenges in managing a global team as described in the scenario.

1. Poor communication among virtual team members. Hence, conflicts, higher stress levels and missed deadlines might happen.
2. Difficulty in planning and monitoring team's project and tasks as the employees are not in a physical office with the project manager.

Sample answer from sir:

- Different cultures from different countries might cause culture shock and this might become an obstacle during the project team development because the project team members came from different Asian countries
- Different backgrounds with different mother tongues (language barriers) might cause misunderstanding and miscommunication as well as communication breakdowns.
- Communication mode: electronic or virtual forms of communication via video conferencing, some of them might not have a good internet and telecommunication infrastructures
- Different working styles and techniques, democratic vs autocratic styles

Question 5

Using a 10% discount rate, calculate the Net Present Value (NPV) and Return on investment (ROI) for Project X and Project Y. Based on your calculations, suggest the most profitable project. Show your calculation to justify your answer (round up discount factor to 4 decimal points).

Discount Rate: 10%					
Project X	Year 0	Year 1	Year 2	Year 3	**Total**
Costs	100,000	50,000	40,000	30,000	-
Discount Factor	1	0.9091	0.8264	0.7513	
Discounted Costs	100,000	45,455	33,056	22,539	201,050
Benefits	0	100,000	120,000	100,000	-
Discount Factor	1	0.9091	0.8264	0.7513	
Discounted Benefits	0	90,910	99,168	75,130	265,208
NPV	265,208 - 201,050 = 64,158				
ROI: Use discounted value	(64,158/201,050) * 100 = 32%				

Discount Rate: 10%					
Project Y	Year 0	Year 1	Year 2	Year 3	**Total**
Costs	100,000	70,000	60,000	20,000	-
Discount Factor	1	0.9091	0.8264	0.7513	
Discounted Costs	100,000	63,637	49,584	15,026	228,247
Benefits	0	100,000	150,000	90,000	-
Discount Factor	1	0.9091	0.8264	0.7513	
Discounted Benefits	0	90,910	123,960	67,617	282,487
NPV	282,487 - 228,247 = 54240				
ROI:	(54240/228,247) * 100 = 24%				

Comment: The most profitable project is project X because it has higher ROI (32%) and NPV (64,518) compared to the ROI (24%) and NPV (54,240) of project Y.

Tutorial 2 : Project Planning, Control & Process Models

Question 1

Both objectives are not SMART objectives.

1. The first objective's time frame and budget limit are not stated.
2. The second objective is too vague as the user friendly is not measurable in the objective. (how can we measure user friendly)

2 SMART Objectives:

- To implement the new system in *three months time* and *within budget of $ 120,000*
- To design a system that is user-friendly in which *the user can use the system effectively and efficiently in 2 weeks time*.

Question 2

The suitable software process model will be the **Spiral model**. Justification:

- The user requirements for the system are still uncertain. Spiral models can help to eliminate the uncertainty by going through every task region.
- This is a high budget project.
- The project scale is large where the Spiral model is suitable as it can account for every possible risk.
- This new system entails a new technology that the software developer team is unfamiliar with. Spiral model is suitable for high technical risk projects.

Sample answer from sir: (15 Dec 2020)

RAD is not suitable because the user requirements are not finalized and the hardware and software technology used to build the new IS are new to the developers, they are not really familiar with these technology tools, plus this project is a large scale project, which involves a lot of stakeholders from different departments. RAD is suitable for small scale projects in which the user requirements are finalized, and the developers already familiar with the hardware and software tools.

- Spiral model is suitable because the developers have no experience building this type of system before, this is the first time they built it. The spiral model allows the developer to build the systems part by part for each iteration.
- Spiral model includes risk management which is suitable for these situations in which the developers are not familiar with the technology and user requirements are not certain yet.
- In the spiral model, each iteration will produce the prototype such as prototype 1, prototype 2 for them to review before the systems become operational after the third iteration.

Spiral model justification:

- Spiral model is more suitable because it involves risk management activities in which it will identify the possible risks and resolve them during the project development life cycle.
- In this case, the user requirements are still uncertain. Hence, the time taken for user requirements engineering activity carried out by the development team is unsure in which there is a high possibility to cause project delay. Therefore, risk analysis activity may be able to help all possible alternatives to cope and help in developing a cost-effective project.
- Prototyping is used in a spiral model to proceed with the available data and find out possible solutions in order to deal with the potential changes in the user requirements.

Question 3

a. Since the team members are experts in their professions, you should not increase the supervision. They don't like to be micromanaged, they are not children, this will make them demotivated , things will get worse, they will quit the project, the project will be further delayed. They need a democratic leaders not autocratic leaders, they need freedom to get the work done. They don't need a leader who tells them step by step details in carrying out their jobs.

b. **Answers:**
   - Decreasing individual supervision, do not micromanaged
   - Streamlining the process, not complicating the process
   - Changing resource priorities, assigned more resources for those who need it most
   - Changing the phasing of deliverables, the outputs and the deadlines
   - Decreasing the number of inspections or supervisions, trust them, they need a leader who trusts their work, not a leader who checks all their works like a children's homework because they are experienced workers.

Question 4

a) You are managing a project A with 12th month's durations and now you are in 10thmonth. The planned value (PV) for the 10th month is RM110,000. The actual cost (AC) of this project is RM115,000 with 80% of the work actually completed and the budget at completion for this project is RM 150,000.

You are required to show the steps in your calculation below:

- Calculate the Earned Value (EV), Schedule Variance (SV) and Cost Variance (CV) for the projects. Comment on your project's status based on the calculated results.
- Measure the cost efficiency and schedule efficiency of budgeted resources.

a. 10th month

AC = 115,000

PV = 110,000

BAC = 150,000

EV = (80% * 150,000) = **120,000**

SV = EV - PV = 120,000 - 110,000 = **10,000**

CV = EV - AC = 120,000 - 115,000 = **5,000**

Comment: The project is within schedule and within budget

Cost Efficiency (EV/AV): 120,000 / 115,000 = 1.04

Schedule Efficiency (EV/PV): 120,000 / 110,000 = 1.09

b) Given the following information in table below:

Table 1: Project A progress

Activity	Estimated Duration (month)	Estimated Cost(RM)	Status	Earned Value
P	1	20,000	50%	10,000
Q	3	20,000	80%	16,000
R	2	30,000	80%	24,000
S	4	40,000	70%	28,000
T	4	45,000	60%	27,000
U	4	55,000	0	
V	2	20,000	0	
Total	20		-	
Total		230,000		105,000

You are managing a project with 20th month's durations and now you are in 10th month. The actual cost (AC) spent for 10 months is RM 95,000. The budget at completion for project A is RM230,000.

- Calculate the Earned Value (EV), Schedule Variance (SV) and Cost Variance (CV) for the projects. Comment on your project's status based on the calculated results. You are required to show the steps in your calculation.

Based on the results calculated on b), propose and explain **ONE (1)** corrective action to ensure the project's success.

10th month

AC = 95,000

PV = 20,000 + 20,000 + 30,000 + 40,000 = 110,000 *(sum of the estimated cost in 10th month)*

EV = 10,000 + 16,000 + 24,000 + 28,000 + 27,000 = **105,000**

SV = EV - PV = 105,000 - 110,000 = **(5,000)**

CV = EV - AC = 105,000 - 95,000 = **10,000**

Comment: The project is behind schedule but still within budget

As you can see from the SV negative value we already know that the project was behind the schedule, we don't need to wait until month 20th , we can know this in advance, then we can do something on it to prevent the project delays.

Corrective actions:

- Decreasing individual supervision
- Streamlining the process
- Changing resource priorities
- Introduce incentive, encourage team
- Add more staff to handle tasks
- Changing the phasing of deliverables
- Decreasing the number of inspection
- Reassign tasks
- Re-plan the project

Tutorial 3 : Quality Management & Assurance

Question 1

"ISO 9001 applies to any organization, regardless of size or industry. More than one million organizations from more than 160 countries have applied the ISO 9001 standard requirements to their quality management systems. Organizations of all types and sizes find that using the ISO 9001 standard helps them." (Source: American Society for Quality)

Discuss THREE (3) reasons why an organization should comply with ISO 9001 standard.

- ISO 9001 is an international set of standards that can be used as a basis for the company to develop a quality system that applies to the design, development and maintenance of the software products.
- ISO 9001 sets out the general quality principles, describes quality processes in general and lays out the organizational standards and ensures all this information is documented in an organizational quality manual.
- ISO 9001 will ensure the company has well defined processes such as product delivery and supporting process and procedures for software development activities that lead to the quality processes of software development activities.

Question 2

Suggest ONE (1) software quality attribute for Beamscope's project (ordering and inventory control system).

Sample Answer 1:

Functionality is one of the important quality attributes that must exist in the system, where it refers to the ability of the Ordering and inventory control system for BeamScope to perform its intended function. Functionality also refers to the process of how features are implemented, where features are the "user tools" that allow users to perform certain tasks (Paget, 2017), such as product ordering and payment. For instance, customers should be able to use this system to order the product they desire.

Measurement :

- ***Accuracy***
  - It could be measured by calculating the percentage of error rate by counting the number of errors occurring when the task is undergoing the testing process divided by the total task undertaken then multiplied by 100%
  - The acceptable percentage of error rate for each task should be smaller than 5%.
- ***Completeness***
  - 0 and 1 will be used to indicate the completeness such that 0 means failed and 1 means completed. For example, if the module is able to achieve all the tasks given, then the module is said to be completed.

Sample Answer 2:

Performance efficiency is one of the product metrics that shall be taken into account for the system. Performance efficiency assesses how well the Ordering and inventory control system for BeamScope in performing the user's intended function. Besides, performance efficiency also refers to the Ordering and inventory control system for BeamScope use of resources which will affect the scalability and responsiveness of the system (Maayan, 2017). The type of resources used may include the CPU, memory, disk and configuration of the system.

Measurement :

- ***The response time of the system when performing certain functions***
    - The system shall be tested under low, moderate and heavy load conditions.
    - For instance, under low load conditions, the system shall provide a 1 second response time while under heavy load conditions, the system's response time shall not exceed 3 seconds.

- ***Number of concurrent users the system can handle***
    - The number of concurrent users the system can handle will be tested through increasing the number of users on the system incrementally until the system is no longer able to process the user requests.

- ***CPU and memory usage under peak conditions***.
    - The CPU and memory usage be utilized as much as possible under peak conditions.
    - For instance, a CPU that remains idle under peak conditions would indicate that the performance efficiency of the system is poorly optimized.

Sample Answer 3:

Usability

This is important in order to ensure the system can achieve its specific goals with effectiveness, efficiency and satisfaction. This can make sure that the system is easy to learn and used by the end user so that the end user is satisfied with the function provided by the system.

Example:

- ***Success rate of the task that carried out by the end user***
    - It can be measured by calculating the percentage of end users to successfully perform a specific task. After that, divide the total number of tasks completed successfully by the total number of tasks undertaken and multiplying it by 100.
- ***Efficiency***

    - To determine how quickly the end user performs a task, task time will be recorded using stopwatch in order to measure the efficiency of the end user to complete a task.
- ***Learnability***
    - Learnability refers to how easy it is for end users to learn and use the system for the first time using the system. It can be measured by recording the time when they are first time using the system and compared with the time that was pre-set by the developer (i.e 10 minutes).
    - If the end users are able to perform the basic features of the system (i.e searching a particular record) within 10 minutes, it indicates that the system has a high learnability which is considered to be easy to learn and use.

Question 3

Visit this website: https://www.infoq.com/articles/create-culture-quality, read the article.

Recommend and elaborate on TWO (2) actions to be carried out to create a quality culture in a software development company

- **Employee ownership & empowerment**
    - Teams should be encouraged to take responsibility for the quality of their work and to develop new approaches to quality improvement such as kaizen, ISO, TQM (total quality management)
    - They should support people who are interested in the intangible aspects of quality and encourage professional behavior in all team members. The purpose of testing and debugging is to find bugs, not to pinpoint their mistakes.

- **Leadership emphasis**
    - Managers need to demonstrate how to “walk the walk” with respect to quality, define meaningful measures of quality, making your metrics visible, using quality in trade-offs, in other words the project manager need to clearly defines their expectations on the quality , what metrics or criterias need to be applied, what are the minimum standard they need to fulfilled.

- **Communication skills**
    - Successful managers need to carefully choose the right way to communicate the quality message to the project teams based on what resonates with their team/ the justification behind the actions, why this need to be done for example for customer satisfaction if they are satisfied with the product, sales improved, sales

experience during demos if the software crash during the sales demo, customer may not buy the software.

- **Peer involvement**
    - Encourage the project team will internalize quality once they begin engage each other about it – and you can help encourage this by taking various steps such as create rituals at design time, evaluate the software design for each others, this includes UI design, database design, architecture design, structural design, perform peer assessments among the teams members, practice pair programming.

Question 4

Refer to the case study in Tutorial 2 Question 1,
Propose TWO (2) product standards for Beamscope's software development project and give reasons to support your proposed product standards.

- **Design review form**
    - This is required to ensure that the design is sound solid and meets the requirements of the user and fulfils all the good design principles. It will also motivate the team members to follow the best practices such as UI design 8 golden rules of design (HCI principles), evaluate the usability of the UI design.

- **Standard naming convention for identifiers and programming style** – Use of comments and indentations
    - This will enhance the readability of the source code and provide ease of maintenance as well, both of which translates to reduced time, effort and cost in coding and maintenance work.

- **Requirements document structure**
    - This would ensure that all the required information is recorded and also provides an organized way of containing the information related to software requirements specifications, design work, implementation and testing.

- **Change request form**
    - This would ensure that all changes made to the software are being kept track properly so that the system evolution can be managed properly. It should be provided in an organized format and then approved by the committee team before starting to research the feasibility (i.e technical feasibility, economic

feasibility) and the impact of change (i.e will it cause project delay? Will it cause a budget overrun?) in the system.

Question 5

Refer to the case study in Tutorial 2 Question 1,

Cleanroom software development is a technique that helps enhance software quality. Evaluate TWO (2) advantages of this technique if it were to be implemented in Beamscope's project.

- **Lower number of errors** because the development team will develop the modules on incremental basis as the user may need to change later, we still can accommodate the user change request and the certification team will test the module using statistical methods until the failure rate is drop to the acceptable levels, beside that these techniques aims to avoid defects in the software, break down the complex components and make sure each components or modules has one entry point and one exit points

- **Lower cost** by lowering the number of errors and defects on the software, we can lower down the repairing cost.

- **Project on schedule** make sure the project can be delivered on time , no defects that caused the project delays.
- **Software of higher quality** can be delivered because the development team will develop the modules on incremental basis as the user may need to change later, we still can accommodate the user change request and the certification team will test the module using statistical methods until the failure rate is drop to the acceptable levels, beside that these techniques aims to avoid defects in the software, break down the complex components and make sure each components or modules has one entry point and one exit points.

Tutorial 4 : Software Metrics

Question 1

Refer to the case study in Tutorial 2 Question 1,
Proposed TWO (2) **normalized metrics** that would be appropriate for Beamscope's project.
Provide justifications to support your answers

Function Point (FP)

- **Documentation / FP**
  This is important as it gives an indication of the **maintainability** of the system. Lack of documentation will result in the team not having the necessary design details that will help them to understand the system prior to performing the maintenance. Very hard to maintain the systems later due to inadequate design information.

- **Team's FPs / person-day**
  This is important as it gives an indication of the **team's productivity**, which in turn helps the project manager monitor the team's progress and take the necessary corrective actions if there are any signs of delay. Delays could be due to the inadequate manpower to perform the project developments activities.

- **Defects found / FP**
  This is important as it gives an indication on the **number of bugs or defects in the software** before the software is released to the users, the software bugs can cause user dissatisfaction especially if the bugs caused the software cannot perform the intended functions.

Question 2

Referring to Table 1, calculate the *function points (FP)* for the both projects. Show the steps in your calculation. Round up your answer to 2 decimal places.

Table 1: Information domain values for Project A and B

Measurement parameters	Weighting factor	Project A's Count	Project B's Count
Number of inputs	Complex (5)	4 = 20	4 = 20
Number of outputs	Simple (2)	6 = 12	5 = 10
Number of inquiries	Average (4)	8 = 32	8 = 32
Number of files	Average (3)	4 = 12	2 = 6
Number of external interfaces	Simple (2)	2 = 4	1 = 2
The adjustment values ∑**Fi** for both projects		50 = 80	40 = 70

Function Point formula: Count Total x [0.65 + 0.01∑Fi]

Referring to Table 2, analyse the quality of project A and B using the normalized defects found and pages of documentation. Using Function Point in normalization, show the details of your calculation. Round up your answer to 2 decimal places. Evaluate which project has *higher quality* based on the calculated result. Justify your answer.

Table 2: Defects found and documentation for Project A and B

	Project A's Count	Project B's Count
Defects found	90	70
Pages of documentation	120	130

Answer:

Function point of project A, FP = 80 * [0.65 + (0.01 * 50)] = 92 ***Defects/FP* of A:** 90/92 = 0.98 **Pg doc/FP of A:** 120/92 = 1.30	**Function point of project B,** FP = 70 * [0.65 + (0.01 * 40)] = 73.5 ***Defects/FP* of B:** 70/73.5 = 0.95 **Pg doc/FP of A:** 130/73.5 = 1.77

Conclusion:

Project B is better than project A because *less defects* as you can see 0.95 < 0.97, and *more documentation* as you can see 1.7 > 1.3 compared with project A.

Question 3

Table 1 shows the size measurement of Project A and B.

Table 1: Project A and B size oriented measures

	Non normalized		Normalized with KLOC	
	Project A	Project B	Project A	Project B
Total Line of Code (LOC)	306,000	256,000	-	-
Errors	288	233		
Defects	30	20		
Page of Documentation	205	180		
*Round up your answer to 4 decimal points.				

KLOC is thousand line of code Round up your answer to 4 decimal points.

Complete the Table 1 column under "Normalized with KLOC" for both projects and compare both projects. Which project has higher quality? Justify your answer.

Answer:

	Non normalized		**Normalized with KLOC**	
	Project A	**Project B**	**Project A**	**Project B**
Total Line of Code (LOC)	306,000	256,000	306,000/1000 = 306	256,000/1000 = 256
Efforts	288	233	288/306 = 0.9411	233/256 = 0.9102 Less errors
Defects	30	20	30/306 = 0.0980	20/256 = 0.0781 Less defects
Page of Documentation	205	180	205/306 = 0.6699	180/256 = 0.7031 More documentation
*Round up your answer to 4 decimal points.				

Project B has higher quality because it has less error, less defects and more documentation than Project A.

Question 4

Refer to the case study in Tutorial 2 Question 1,
The senior management considers ***security*** as the most important quality attribute that should be included in the new system.

Identify and illustrate TWO (2) example **metrics** that may be used in the proposed system to measure the proposed security attribute.

- **Attack and threat frequency**
    - How many attacks are detected for a certain time period, e.g. daily, weekly etc.? How many attempts of unauthorized access? Do servers/ databases are identified?
    - People attempt to hack into the servers or database servers. A vulnerability scanner software that includes all the assets will indicate what needs to be done to improve the SAP system security.
    - The higher frequency means the company system security is vulnerable and more work needs to be done to improve it.
    - E.g Use of honeypots and vulnerability scanners to detect unauthorized access.

- **Mean Time to Identify (MTTI)**
    - *Average length of time taken for a security team to discover/identify the threats/attacks in the SAP system.*
    - The lower the time taken will be better as they will be able to quickly limit any damage done by the cyber-attack incident. They can take precautionary measures before the attacks begin.

- **Mean Time to Remediate (MTTR)**
    - *Amount of time taken by the security team to resolve the attacks/ threats within the SAP system and restore its service back to normal.*
    - The shorter time taken will be better. Normally, threat remediation is the process organizations use to identify and resolve threats to their company network environment. Recovers from the attacks, backup systems to restore back, fault tolerant hardware (DOS attacks)

Extra information for Q4 :

- % of systems with formal risk assessments
- % of system with tested security controls
- % of weak passwords (noncompliant) identified
- No. of identified security risks and their severity % of systems with contingency plans
- Successful/unsuccessful logons recorded
- No. of security breach incidents reported
- No. of viruses blocked or quarantine
- No. of patches applied on the OS and software
- No. of spam blocked
- No. of virus infections detected by AV
- Size and complexity of the systems
- Defects/LOC
- Defects (severity, type) over time
- Cost per defect

Tutorial 5: Risk Management

Question 1

Refer to the case study in Tutorial 2 Question 1, Differentiate the following **risk management strategies** with appropriate examples from the Beamscope project: risk acceptance, risk mitigation and risk transfer.

- **Risk acceptance**
  - The “do nothing” option. In the risk prioritization process, it would have been decided for some risks to be ignored in order to concentrate on the more likely or damaging risks. For some risks, the damage inflicted would be less than the costs of action that might reduce the probability of a risk happening. (impact < cost) not worth to do it, less possibility it will happen
  - Technology Risk, Failure of third party gateway , UPS, There is nothing much that the development team has control of and can only wait for the third party gateway to recover by the UPS side.
- **Risk mitigation**
  - Take the necessary action(s) to ensure that the impact of the risk is lessened when it occurs.
  - Financial risk, The project might cost more than estimated before due to the hardware might be broken due to the environment or technical issues which required additional capital to replace them. Project team shall only purchase high-quality hardware in order to reduce the maintenance cost and downtime of the system.
- **Risk transfer**
  - Transfer the risk to another person or organization.
  - People risk The project team members are not equipped with appropriate skills to complete the project. Use the contingency allowances to hire third party expertise that has experience to complete and lead the project team to achieve their goals.

Question 2

Refer to the case study in Tutorial 2 Question 1, Beamscope's project team has suggested that junior staff should be assigned with non-critical tasks so that if anything goes wrong (e.g., late delivery of the assigned task), there will be no big impact towards the project's deadline. Identify the TWO (2) strategies that can be used by the project team to manage the risk.

Assigning the junior staff with non critical tasks can help to reduce the possibility of slippage/ project delays- i.e. project schedule to be delayed to happen.

1. **Look for those task or activities which slack value more than 0**, Most of the non -critical tasks are having buffer time to be completed (slack is not = 0 in PERT chart), at least if due to junior staffs' still "new" and have limited knowledge and skill, they still have some extra time to complete the tasks without need to delay the overall project duration.
2. There may be a rare situation whereby the junior staffs complete the non critical tasks exceeding the buffer time deadline. At least the senior staff can take over if necessary. If the risk really happens, the project manager adopts a risk mitigation strategy to **minimize the impact of the occurred risk by allowing the senior staff to take over the roles**.

Question 3

Consider the following risk table in table 1: Risk Analysis

Risks	Category	Probability of Occurrence	*Impact	Risk Score
Unstable database	TE	50%	3	
Inadequate software architecture	PR	30%	2	
Errors caused by team members	ST	60%	4	
Constant changes in requirements	PS	10%	1	

*Impact values: 1 – negligible 2 – marginal 3 – critical 4 – catastrophic

a) Calculate the risk score for each risk, rank the risks according to their priority (i.e., from highest to lowest risk scores). Show details of your working and round up your answer to 2 decimal places.
b) Propose **ONE (1)** *risk management strategy* for the risk with the highest priority that you identified in part a).

Ranking the Risk (highest to lowest)	Probability of Occurrence (%)	*Impact on the project (1-4)	Risk Exposure (RE), Risk Score sorted
Errors caused by members	60%=0.6	4	0.6 x 4 =2.4
Unstable database	50%=0.5	3	0.5 x 3 = 1.5
Inadequate software architecture	30%=0.3	2	0.3 x 2 = 0.6
Constant changes in requirements	10%=0.1	1	0.1 x 1= 0.1

b.

- The risk with the highest priority is Errors caused by members, the value is 2.4 compared with others risk.
    - We can **introduce peer reviews** in which team members evaluate each other's work products for technical quality and content.
    - **Testing stage should carry out a few rounds**, this would enable more bugs and errors to be discovered and then rectified before the project goes live.
    - We should have a **proper configuration management**, version controls, to keep track the changes make by the team members, if necessary we can roll back to the previous version of the code, just in case the code added or modified by the team members has bugs
    - The IDE we used here for example visual studio should be able to **support the group project environment**, keep track of the changes done by the team members.

Question 4

Refer to the case study in Tutorial 2 Question 1 & 2,
You are required to

a) Identify the **TWO (2)** potential risks for the Beamscope project from *different categories* and *impact value* for each risk.

b) For each of the risks that you identified in part a),
- Identify and explain the category that the risk belongs to.
- Illustrate the impact to this project should the risk occur.
- Propose a suitable risk mitigation monitoring and management actions for each risk.

Risk log format as shown below:

Risk name	Category	Impact	Risk Mitigation, Monitoring and Management activities
			Mitigation: Monitoring: Management:

Impact values: 1 – negligible, 2 – marginal, 3 – critical , 4 – catastrophic

Answer:

Risk name	Category	Impact	RMMM
Unclear users' requirements	Customer characteristic (CU) communication between customer with developers	3 Unclear requirements will cause the end product to meet the project objectives. Quality of the product is compromised here, customer expectation is not meet here	Mitigation: Use prototyping to confirm customer requirements that are unclear Monitoring: Observe and record users' response during prototyping demos Management: Prototyping to obtain feedback from users; Feedback is incorporated into improving the system
New and unfamiliar development tool	Development environment (DE) availability and quality of the tools to be used to build the product	2 Unfamiliar development tools cause developers to spend time learning and they could make mistakes also, learning can delays their work also	Mitigation: research on a new or similar technology, feedback to team leaders. Monitoring: Observe and testing the tool before use for development Management: outsource to another 3rd party.

The project team members are not equipped with appropriate skills to complete the project.	People Risk	4	Risk Mitigation: - Register a course for the project team to learn about new skills, to ensure that all the team members have sufficient knowledge to complete the project. Monitoring: - Monitor the attitude of the project team and motivate the project team to ensure that they are keen to learn new skills. Management: - Use the contingency allowances to hire third party expertise that has experience in using new skills in order to lead the project team to achieve their goals.
Users does not accept and do not want to use the system.	Market Risk	4	Risk Mitigation: - Simplifying the ordering process and ensure that it is user-friendly. Monitoring: - Check whether the new system is user-friendly, so that users can easily use and learn the system.

Tutorial 6: Software Process Improvement

Question 1

Refer to the case study in Tutorial 1 Question 3,

Identify **TWO (2)** factors should be considered when carrying out software process improvement to the Ordering System of T-Shirt 2U company.

Each company has to develop its own SPI depending on:

- **Company's size**- small or medium or large enterprise
- **Staff's background and skills** – CI, QM, QA, TQM, ISO, experience, knowledge, skills
- **Type of software being developed**- critical or non-critical software/ online-based or web-based system
- **Customer and market requirements** – Microsoft, Apple served a large market based, some products needs ISO/ demand or need
- **Local environment**- regulations or competitors strategy
- **Company culture** – focus on the quality , willing to improved their products or services , TQM, CQI, Kaizen, Quality Culture

Question 2

You are measuring a software process to solve an issue which is to *shorten the development time of a programmer*. It was found that software development time always takes longer than planned. 2 main areas that might contribute to the issue are: time required to finalize product requirements with customers and requirement changes. Hence, you have identified 4 metrics in measuring these 2 areas which are time taken for communication with customer, number of communication with customer and pages of requirement documentation. On the other hand, you also found that your top management does not agree with your findings and thus will not support your software improvement process (SPI) efforts financially. Seeing that the management is not supportive, your colleagues appeared less cooperative in giving you feedback when you tried to collect the data for process analysis.

a) Construct a Goal-Question-Metric paradigm to illustrate the software process improvement goal as *shorten the development time.*

- Formulate TWO (2) questions to assess the given goal.
- Provide TWO (2) appropriate software metrics for each question you have listed.

b) You have decided to carry out the process change of SPI. Identify **TWO (2)** problems or difficulties that you might face.

a. **Sample Answer**:

   Question 1: Is the amount of time allocated for you to communicate with the customer to obtain feedback sufficient or not ?

   Metrics:

   1. How much time taken or needed for communication with customer
   2. What types modes of communication used – written, oral

Question 2: Are requirement changes documented properly ?
Metrics:
1. no of pages of requirement documentation
2. time taken to change the requirements – process and approved them

b. You have decided to carry out the process change of SPI. Identify TWO (2) problems or difficulties that you might face. (can be found on article - question)

- **No support from top management** because the top management does not agree with your findings and thus will not support your software improvement process (SPI) efforts financially.
- **No support from the colleagues**, seeing that the management is not supportive, your colleagues appeared less cooperative in giving you feedback when you tried to collect the data for process analysis.

Question 3

Refer to the case study in Tutorial 1 Question 3,
Discuss any TWO (2) possible changes that you may implement to achieve software process improvement for the T-Shirt2U project.

- **Introducing new practices, methods or processes of software developments** – new methodology that supports iterative works and prototyping , currently we do waterfall model only. We can change to prototyping methodology which is considered user centered design methodology that focuses on user need.
- **Changing the ordering of process activities**; before this we use the waterfall model sequential based, there is no iterative mode which cannot U turn back to previous stage.
- **Introducing new or removing old deliverables**; With the new methodology that supports prototyping, it requires user to submit the low fidelity prototype for each stages and review works, requires us to create user persona
- **Introducing new roles or responsibilities** as we adopt a new software development process we need to create the new role for example UI and UX designers to support the prototyping process.

Question 4

Refer to the case study in Tutorial 2 Question 1,
During the execution of the project, the senior management at Beamscope finds that it is quite difficult to trace the progress of the project.

Propose the TWO (2) most significant process attributes that the senior management has to consider during the Software Process Improvement (SPI) activity with the major goal to *improve the project's progress visibility*.

- We want to keep track of the progress here as a part of project monitoring and controlling activities
- **Visibility** – milestone report, Earned Value (EV) report, progress(%) work done in MS Project, to measure the effectiveness (have we completed all the tasks?)
    - Do the process activities culminate in clear results, so that the progress of the process is externally visible?
    - Is the project having a clear definition of how it will be performed, with all clear tasks list (with deadlines), including resources allocation and potential risks.
    - Additionally, has everyone involved in the project fully understand their assigned task and their role in helping to meet the project goal?
    - Is the project manager having a real time overview of work status, blocked work items or tasks ready for review to help to improve project's flow efficiency?

- **Measurability** – time and resources needed to complete the task for us measure the efficiency
    - Does the process include data collection or other activities that allow process or product characteristics to be measured? Such as time needed to finalized user requirement, process user change request, number of communication channels used, FP
    - Is there any metrics to be defined for all the assigned tasks to check to trace the project progress visibility from time to time? Such as time needed to finalized user requirement, process user change request, number of communication channels used, overallocated resources reports in MS Project

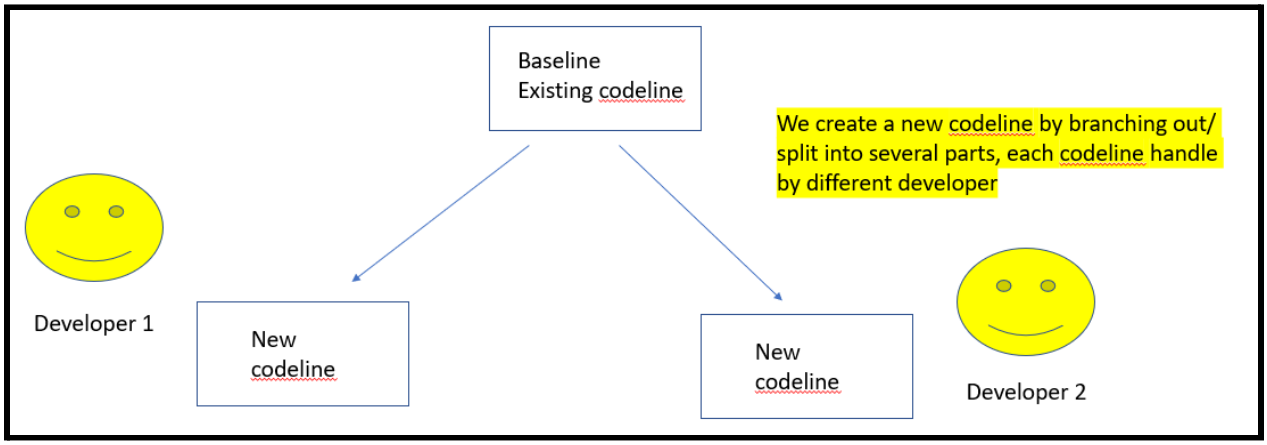
Tutorial 7: Software Configuration Management

Question 1

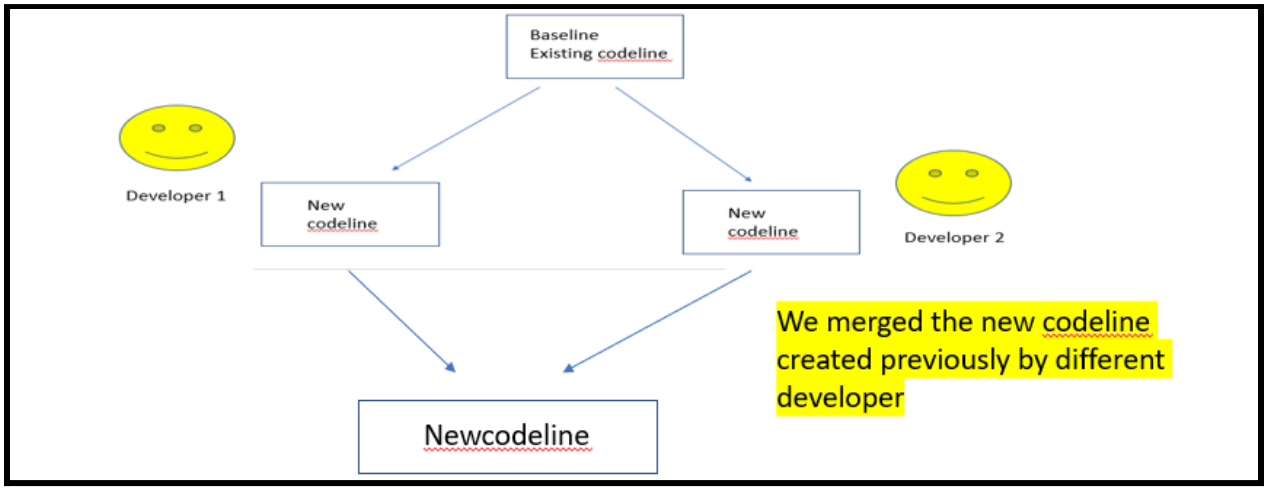
In the context of version management,

a) Describe what is branching and merging, and explain how these two terms are related

Branching / split is the *creation of a new codeline* from a version in an existing codeline. The new codeline and the existing codeline may then develop independently.



Merging/ join, The creation of a new version of a software component by merging separate versions in different codelines. These codelines may have been created by a previous branch of one of the codelines involved.



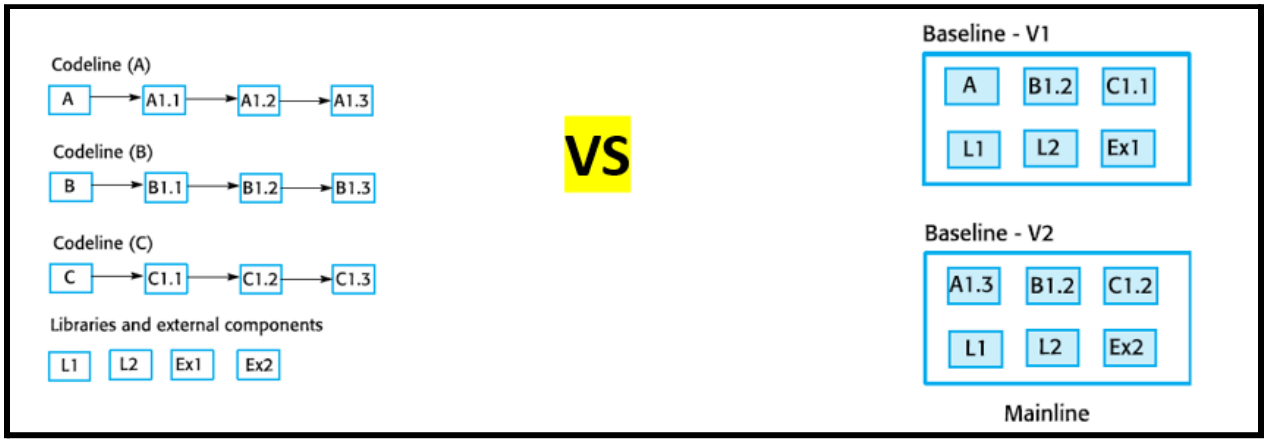
b) Describe the relationship between codelines and baselines

Codeline

i) A codeline is a sequence of versions of source code with later versions in the sequence derived from earlier versions. Codelines normally apply to components of systems so that there are different versions of each component.

Baseline/ package – folder or directory something like awt or swing packages or we can use package command in java

ii) A baseline is a definition of a specific system. The baseline therefore specifies the component versions that are included in the system plus a specification of the libraries used, configuration files, etc. Present information in others format



Question 2

System release is a version of a software system that is distributed to customers. Discuss TWO (2) factors that you should consider when releasing a new version of software

Factors Influencing System Release Planning

7.5 Release Management

Factor	Description
Competition	For mass-market software, a new system release may be necessary because a competing product has introduced new features and market share may be lost if these are not provided to existing customers.
Marketing requirements	The marketing department of an organization may have made a commitment for releases to be available at a particular date.
Platform changes	You may have to create a new release of a software application when a new version of the operating system platform is released.
Technical quality of the system	If serious system faults are reported which affect the way in which many customers use the system, it may be necessary to issue a fault repair release. Minor system faults may be repaired by issuing patches (usually distributed over the Internet) that can be applied to the current release of the system.

Question 3

One of the change management activities is to approve the change requests from stakeholders. Discuss the **factors** that influence the decision on whether **a change request should be approved**

- **The consequences of not making the change**, if we did not make the changes, our competitor may offer better features which will cause us to lose our customers as we cannot provide a better service to them compared to our competitors.
- **The benefits of the change**, if we change our software product, will give a better satisfaction to our customers, with the improved usability and performance.
- **The number of users affected by the change**, the number of users who is currently using our software product, we should ease the process of upgrade, e.g. window 8 to window 10 with free upgrade limited time
- **The costs of making the change** should be less than the benefits of the changes, e.g positive NPV,
- **The software product release cycle**, if the software product is already in the declining market, going to be obsolete soon, there is no need to change it because there is no demand for the product.

Tutorial 8: System Dependability & Critical System

Question 1

Compare and contrast safety and resilience of system dependability

- **Safety** measures the capability of the systems to operate without causing cataphoric failure. A judgment of how likely or possibility that the system will or can cause damage to people or its environment. How safe is it to use the software product ? Is our system subject to DDOS cyber attacks?

- **Resilience** measures the resistance and recovery from the damaging events. A judgment of how well a system can maintain the continuity of its critical services in the presence of disruptive events such as equipment failure and cyber-attacks. How fast can we recover from DDOS attacks or how resilient our systems are towards DDOS attacks ?

Question 2

Consider the following scenario:

"The Food and Drug Administration (FDA) has approved the first automated insulin-delivery system. This represents a step toward a called artificial pancreas that could automatically regulate blood sugar levels for people who have diabetes. The device made by the manufacturer Medtronic has been approved to treat people with Type 1 diabetes who ages 14 and older."

(Source: https://www.livescience.com/56305-automated-insulin-delivery-device-approved.html)

a) Identify any TWO (2) important dependability dimensions that apply to the automated insulin delivery system. Justify your answer.

i) **Availability**. The probability that the system will be up and running and able to deliver useful services to users, in this case able to deliver the insulin at the right amount of dose to the users when the user's blood sugar levels need to be regulated by the insulin.

ii) **Reliability**. The probability that the system will correctly deliver services as expected by users, in this case the right amount of insulin dosage should be delivered at the right quantity and right time, too much insulin dosage or inadequate insulin dosage can be harmful to the patients

iii) **Safety**. A judgment of how likely it is that the system will cause damage to people or its environment, in this case if the systems fails to deliver the right amount of insulin at the right time it can be a disaster to the users who are the diabetes patients, the user should be alarmed if something not right and be able to reset the systems accordingly during emergency.

b) Safety is an important quality attribute to the insulin-delivery system. Suggest TWO (2) appropriate safety requirements.

SR1: The system shall not deliver a single dose of insulin that is greater than a specified maximum dose for a system user.

SR2: The system shall not deliver a daily cumulative dose of insulin that is greater than a specified maximum daily dose for a system user.

SR3: The system shall include a hardware diagnostic facility that shall be executed at least four times per hour.

SR4: The system shall include an exception handler for all of the exceptions

SR5: The audible alarm shall be sounded when any hardware or software anomaly is discovered and a diagnostic message,

SR6: In the event of an alarm, insulin delivery shall be suspended until the user has reset the system and cleared the alarm.

Question 3

Give and describe TWO (2) examples of critical systems, which include a mission-critical system and a business-critical system. For each system that you have given, assess which dimension of system dependability is the most important. Provide justifications to support your answer.

Mission critical systems	Business critical systems
• A system whose failure may result in the failure of some goal-directed activity/ mission failed • A **navigational system** for a spacecraft, bring the astronaut to the mars planet at the specified coordinates or launch and landed at the specified coordinates • **Reliability** is the most important system dependability attribute that we need to address here. This is because we need to make sure the system can works accurately as specified able the launch and landed at the specified coordinates, failing to do so landed at the wrong place mission failed and can be dangerous to the spacecraft passengers	• A system whose failure may result in the failure of the business using the system • A **customer account system** in a bank, operated via online banking platform, that allows the user to perform online banking transactions over the internet. • **Security** is the most important system dependability attribute that we need to address here. This is because we need to make sure the system is secured from unauthorized access or accidental intrusion from cyberattacks, the customer will lose their bank accounts money and lose confidence if the systems failed to provide adequate security to protect their money and data.

Business critical system :
Online banking systems which allows its customers to perform online banking transactions such as pay bills online, transfer money to another account, check account balance online, etc.

Question 4
Discuss the importance of redundancy approach to a business-critical system. Explain your answer with an example of a business-critical system.

- For example an ecommerce online ordering systems, during the peak hours , such as 12.12 events , we are expecting a high volume of network traffics and request from the client's site, we should have a backup servers to handle such volumes of client request, fault tolerance hardware, failing to do so, may caused the client dissatisfaction as the systems is not available for them to use, they may turn to another ecommerce providers to placed their orders,
- Redundancy: Keep more than one version of critical components so that a backup is available ,if availability is critical (e.g. e-commerce systems), companies keep backup servers and switch to these automatically if failure occurs to ensure the systems is always available at 24 x 7 during the peak hours

Goal	Purpose Issue Object (process) Viewpoint	Improve the timeliness of change request processing from the project manager's viewpoint
Question	Q1	What is the current change request processing speed?
Metrics	M1 M2 M3	Average cycle time Standard deviation % cases outside of the upper limit
Question	Q2	Is the (documented) change request process actually performed?
Metrics	M4 M5	Subjective rating by the project manager % of exceptions identified during reviews
Question	Q3	What is the deviation of the actual change request processing time from the estimated one?
Metrics	M6 M7	$\frac{\text{Current average cycle time - Estimated average cycle time}}{\text{Current average cycle time}} * 100$ Subjective evaluation by the project manager
Question	Q4	Is the performance of the process improving?
Metrics	M8	$\frac{\text{Current average cycle time}}{\text{Baseline average cycle time}} * 100$
Question	Q5	Is the current performance satisfactory from the viewpoint of the project manager?
Metrics	M7	Subjective evaluation by the project manager
Question	Q6	Is the performance visibly improving?
Metrics	M8	$\frac{\text{Current average cycle time}}{\text{Baseline average cycle time}} * 100$