# 2022. Question 3.

**(a) IEEE Standard 12207-2017 Systems and software engineering — Software life cycle processes distinguishes between two parties: acquirer and supplier. [6 marks]**

(i) For the project led by Thomas, identify an acquirer and a supplier of the project. 对于 Thomas 领导的项目，确定项目的收购方和供应商。

(ii) Other than Charles, Queenie, Thomas and other staff in the IT Department of City Hospital, identify TWO stakeholders of the project. Briefly explain your answers. 除了 Charles、Queenie、Thomas 和市立医院 IT 部门的其他工作人员之外，确定该项目的两个利益相关者。 简要解释你的答案。

**ANS:**

**(i)** For the project led by Thomas, the acquirer is the City Hospital, and the supplier is the IT Department of City Hospital, as they are responsible for developing and delivering the CHESS system. 收购方是市医院，供应商是市医院 IT 部门，因为他们负责开发和交付 CHESS 系统。

**(ii)** Other than Charles, Queenie, Thomas, and other staff in the IT Department of City Hospital, two stakeholders of the project could be: 除了 Charles、Queenie、Thomas 和市立医院 IT 部门的其他员工外，该项目的两个利益相关者可能是：

1. Hospital staff: Hospital staff such as doctors, nurses, and administrative personnel will use the CHESS system to access patient records and carry out their duties. They are stakeholders as they will be impacted by any changes to the system and will require proper training to effectively use the new functionalities. 医院工作人员：医生、护士和行政人员等医院工作人员将使用 CHESS 系统访问患者病历并履行职责。 他们是利益相关者，因为他们会受到系统任何更改的影响，并且需要适当的培训才能有效地使用新功能。

2. Patients: Patients of the City Hospital are stakeholders as the CHESS system stores their medical records and personal information. The new functionalities related to COVID-19 will directly affect the quality of care that patients receive, and any changes to the system could potentially impact their privacy and security. It is important to ensure that the system is designed and developed with the patient's needs in mind, and that they are adequately informed of any changes to the system that may affect them. 患者：城市医院的患者是利益相关者，因为 CHESS 系统存储了他们的病历和个人信息。 与 COVID-19 相关的新功能将直接影响患者接受的护理质量，系统的任何更改都可能影响他们的隐私和安全。 重要的是要确保系统的设计和开发考虑到患者的需求，并确保他们充分了解可能影响他们的系统变化。

**(b) IEEE Standard 12207-2017 also defines many software life cycle processes. [8 marks]**

**(i)** State ONE life cycle process or activity in City Hospital that is NOT confined to one software project. Clearly justify your answer. 陈述城市医院中不局限于一个软件项目的一个生命周期过程或活动。清楚地证明你的答案。

(ii) State TWO approaches to assess the quality of the life cycle process or activity you stated in part (b)(i) above. 两种方法来评估您上面（b）（i）部分中所述的生命周期过程质量或活动的质量

**ANS:**

**(b)(i)** One life cycle process or activity in City Hospital that is not confined to one software project is the maintenance process. The maintenance process is an ongoing activity that involves making modifications to the software after it has been released to address bugs, security vulnerabilities, or to add new features. In City Hospital, the CHESS system is a critical component of the hospital's operations, and it is likely that maintenance activities will be required throughout the system's lifecycle to ensure its continued reliability and security.维护过程是一项持续的活动，涉及在软件发布后对软件进行修改以解决错误、安全漏洞或添加新功能。 在城市医院，CHESS 系统是医院运营的重要组成部分，很可能需要在系统的整个生命周期内进行维护活动，以确保其持续的可靠性和安全性。

**(b)(ii)** Two approaches to assess the quality of the maintenance process in City Hospital could include: 评估城市医院维护过程质量的两种方法包括：

1. Metrics-based approach: This approach involves defining metrics that can be used to measure the effectiveness and efficiency of the maintenance process, such as the time to fix bugs, the frequency of security patches, and the number of incidents reported by users. By tracking these metrics over time, the IT Department can identify areas for improvement and measure the impact of process changes. 1.基于指标的方法：这种方法涉及定义可用于衡量维护过程的有效性和效率的指标，例如修复错误的时间、安全补丁的频率以及用户报告的事件数量。 通过随着时间的推移跟踪这些指标，IT 部门可以确定需要改进的领域并衡量流程变更的影响。

2. Process-based approach: This approach involves defining a set of processes and procedures for carrying out maintenance activities and ensuring that they are followed consistently across all projects. This could include processes for bug tracking, change management, and release management. By establishing and adhering to these processes, the IT Department can ensure that maintenance activities are carried out in a consistent and repeatable manner, which can improve the overall quality of the software. 2.基于过程的方法：这种方法涉及定义一组用于执行维护活动的过程和程序，并确保它们在所有项目中得到一致遵循。 这可能包括错误跟踪、变更管理和发布管理的流程。 通过建立和遵守这些流程，IT 部门可以确保以一致和可重复的方式执行维护活动，从而提高软件的整体质量。

**(c) ISO 9001:2015 requires the application of Plan-Do-Check-Act (PDCA) cycle to all processes.** To what extent does the IEEE inspection process, as defined in IEEE Standard 1028-2008 for Software Reviews and Audits, illustrate the application of PDCA?

IEEE 软件审查和审计标准 1028-2008 中定义的 IEEE 检查过程在多大程度上说明了 PDCA 的应用？

EXPLAIN your answer

**ANS:**

The IEEE inspection process, as defined in IEEE Standard 1028-2008 for Software Reviews and Audits, can be seen as a practical application of the PDCA (Plan-Do-Check-Act) cycle. IEEE 检查过程可以看作是 PDCA（计划-执行-检查-行动）循环的实际应用。

- Plan: In the planning phase, the team responsible for conducting the inspection will plan the review, including defining the objectives, selecting the participants, and setting a timeline. This phase can be seen as the planning stage of the PDCA cycle, where the team identifies the problem, sets goals, and develops a plan to address the issue. 计划：在计划阶段，负责执行检查的团队将计划审查，包括确定目标、选择参与者和设定时间表。 这个阶段可以看作是 PDCA 循环的计划阶段，团队在此阶段确定问题、设定目标并制定解决问题的计划。

- Do: In the doing phase, the team will conduct the actual review, which involves examining the code or documentation to identify errors, inconsistencies, and other issues. This phase can be seen as the execution stage of the PDCA cycle, where the team puts the plan into action and carries out the review. 做：在做阶段，团队将进行实际审查，包括检查代码或文档以识别错误、不一致和其他问题。 这个阶段可以看作是PDCA循环的执行阶段，团队将计划付诸行动并进行审查。

- Check: In the checking phase, the team will evaluate the results of the review to identify any issues that were found, and to determine if the review met its objectives. This phase can be seen as the checking stage of the PDCA cycle, where the team evaluates the results to determine if the plan was effective. 检查：在检查阶段，团队将评估审查结果以确定发现的任何问题，并确定审查是否达到其目标。 这个阶段可以看作是 PDCA 循环的检查阶段，团队在这个阶段评估结果以确定计划是否有效。

- Act: In the acting phase, the team will take corrective actions to address any issues that were identified in the review. This phase can be seen as the acting stage of the PDCA cycle, where the team takes action to improve the process based on the results of the review. 行动：在行动阶段，团队将采取纠正措施来解决审查中发现的任何问题。 此阶段可以看作是 PDCA 循环的执行阶段，团队在此阶段根据审查结果采取行动改进流程。

In summary, the IEEE inspection process can be seen as a practical application of the PDCA cycle, where the team plans the review, executes the review, checks the results, and takes action to improve the process. By using this process, the team can continuously improve the quality of the software being developed and ensure that it meets the desired quality standards. 综上所述，IEEE 检查过程可以看作是 PDCA 循环的实际应用，团队计划审查、执行审查、检查结果并采取行动改进过程。 通过使用这个过程，团队可以不断提高正在开发的软件的质量，并确保它满足期望的质量标准。

# 2022. Question 4.

**(a) According to ISO/IEC 25010:2011 SQuaRE — System and software quality models, the product quality model defines 8 quality characteristics (requirements) as follows. [10 marks]**

• Functional suitability • Compatibility • Usability • Reliability

• Performance efficiency • Maintainability • Security • Portability

(i) With respect to the software project mentioned in the Case Description, suggest what its product needs to achieve in terms of THREE of these quality characteristics. 针对案例描述中提到的软件项目，根据这些质量特征中的三个，提出其产品需要达到的目标。

**ANS:**

Based on the case description, the software project needs to achieve the following quality characteristics:

Usability: The new mobile app interfaces should be user-friendly and easy to use so that the patients, doctors, and other hospital staff can use it without any difficulty.

Reliability: The software should be reliable and free from errors and bugs as it handles critical information related to patients, medical history, treatments, and billing.

Security: The software must ensure the security and privacy of sensitive patient data, and protect against unauthorized access, modification, or deletion.

(ii) Choose any TWO of the quality characteristics that you suggest in part (a)(i) above. For EACH of these two, suggest ONE metric or method for assessing the software product in terms of the extent of achievement of the quality characteristic. 选择您在上面 (a)(i) 部分中建议的任何两个质量特征。 对于这两个中的每一个，建议一个度量或方法来根据质量特性的实现程度来评估软件产品。

1. Usability: A metric for assessing the usability of the software product can be the System Usability Scale (SUS) which measures the user satisfaction with the overall usability of the system. Another method can be heuristic evaluation, where usability experts evaluate the software against a set of established usability principles. 可用性：评估软件产品可用性的指标可以是系统可用性量表 (SUS)，它衡量用户对系统整体可用性的满意度。 另一种方法是启发式评估，可用性专家根据一组已建立的可用性原则评估软件。

2. Security: A metric for assessing the security of the software product can be the number of vulnerabilities or security flaws found during a security testing and audit. Another method can be a penetration testing, where ethical hackers simulate real-world attacks to identify and exploit vulnerabilities in the software. 安全性：评估软件产品安全性的指标可以是在安全测试和审计期间发现的漏洞或安全缺陷的数量。 另一种方法可以是渗透测试，其中道德黑客模拟真实世界的攻击以识别和利用软件中的漏洞。

以下是对每个质量特性的具体度量或方法来评估它们的实现程度：

• Functional suitability（功能适用性）：度量软件功能的完整性、正确性和适用性。可以使用功能点分析或测试覆盖率等方法进行评估。

• Compatibility（兼容性）：度量软件与其他系统或组件的交互性。可以测试软件与其他系统或组件的集成，以及测试不同操作系统、浏览器或设备之间的兼容性。

• Usability（易用性）：度量软件的易用性和用户友好性。可以使用用户体验测试、专家评审和用户调查等方法来评估软件的易用性。

• Reliability（可靠性）：度量软件在特定环境下的稳定性和可靠性。可以使用故障注入测试、故障树分析和可靠性建模等方法来评估软件的可靠性。

• Performance efficiency（性能效率）：度量软件在特定负载和资源限制下的性能和效率。可以使用性能测试、负载测试和基准测试等方法来评估软件的性能效率。

• Maintainability（可维护性）：度量软件的可维护性和可重用性。可以使用代码复杂度分析、代码审查和静态代码分析等方法来评估软件的可维护性。

• Security（安全性）：度量软件的安全性和对潜在攻击的抵御能力。可以使用漏洞扫描、黑盒测试和白盒测试等方法来评估软件的安全性。

• Portability（可移植性）：度量软件在不同环境下的移植性和可移植性。可以测试软件在不同平台、操作系统和设备上的兼容性，以及使用标准化技术和协议来实现可移植性。

**(b) Queenie advises Thomas to do proper risk management for his project. [10 marks]**

(i) Identify a high priority TECHNICAL RISK of Thomas’ project. JUSTIFY your answer. 确定 Thomas 项目的高优先级技术风险。 证明你的答案。

**ANS:**

A high priority technical risk for Thomas' project could be the integration of new COVID-19 related functionalities into CHESS. As CHESS is an existing system with multiple subsystems, the integration of new functionalities could lead to unexpected issues in the existing subsystems or in the overall system. Additionally, the new functionalities related to COVID-19 may have unique technical requirements that are not currently supported by the existing system. This could lead to compatibility or performance issues. Thomas 项目的一个高优先级技术风险可能是将新的 COVID-19 相关功能集成到 CHESS 中。 由于 CHESS 是一个包含多个子系统的现有系统，新功能的集成可能会导致现有子系统或整个系统出现意外问题。 此外，与 COVID-19 相关的新功能可能具有现有系统目前不支持的独特技术要求。 这可能会导致兼容性或性能问题。

(ii) Recommend ONE CONCRETE ACTION to follow up the risk. 建议采取一项具体行动来跟进风险。

One concrete action to follow up the risk is to conduct a thorough system analysis and design before integrating the new functionalities. This includes identifying the technical requirements of the new functionalities, reviewing the existing system design, and identifying potential technical conflicts or incompatibilities. The analysis and design should involve a team of experienced software engineers and domain experts to ensure that the new functionalities are integrated in a technically sound and efficient manner. Additionally, a comprehensive testing plan should be developed and executed to validate the integration and ensure that the existing system functions as expected after the integration. 跟进风险的一项具体行动是在集成新功能之前进行彻底的系统分析和设计。这包括确定新功能的技术要求、审查现有系统设计以及确定潜在的技术冲突或不兼容性。 分析和设计应由经验丰富的软件工程师和领域专家组成的团队参与，以确保以技术上合理且高效的方式集成新功能。 此外，应制定并执行全面的测试计划以验证集成并确保现有系统在集成后按预期运行。

# 2021. Question 3.

ISO 9001:2015 requires the application of Plan-Do-Check-Act (PDCA) cycle to all processes, with focus on risk-based thinking.

**(a)** Your team leader, Timothy, identifies a high priority risk. Although the contract includes a specification written by CHESS listing the requirements of LinKids, Timothy worries that a prototype developed in compliance with the contract may not satisfy the implied needs of CHESS and, hence, may fail to demonstrate the expected benefits afterwards. 您的团队负责人 Timothy 确定了一个高优先级风险。 尽管合同中包含 CHESS 编写的规范，其中列出了 LinKids 的要求，但 Timothy 担心按照合同开发的原型可能无法满足 CHESS 的隐含需求，因此可能无法在之后展示预期的收益。

**(i)** Suggest ONE REASON justifying Timothy’s worry of the risk. Then recommend ONE TREATMENT action to mitigate or resolve the risk. [4 marks] 提出一个理由来证明蒂莫西对风险的担忧。 然后推荐一种治疗措施来减轻或解决风险。

**ANS:**

Timothy's worry is justified because implied needs are often not explicitly stated in the contract and may only surface during the actual usage of the prototype. This can lead to dissatisfaction with the delivered product and can cause the failure to demonstrate the expected benefits. 担忧是合理的，因为合同中通常没有明确说明隐含的需求，并且只能在原型的实际使用过程中表现出来。这可能会导致对交付的产品不满，并可能导致未能证明预期收益。

One treatment action to mitigate this risk is to conduct regular reviews with the CHESS stakeholders to ensure that the prototype meets their implied needs and expectations. 缓解这种风险的一种治疗措施是与象棋利益相关者进行定期审查，以确保原型满足其隐含的需求和期望

To mitigate or resolve this risk, Timothy can adopt a requirements validation process that involves reviewing and verifying the requirements with the CHESS stakeholders to ensure that all needs and expectations are captured and well-defined. 为减轻或解决此风险，Timothy 可以采用需求验证流程，其中涉及与 CHESS 利益相关者一起审查和验证需求，以确保捕获并明确定义所有需求和期望。

**(ii)** IDENTIFY another high priority risk and JUSTIFY your answer. Then recommend ONE concrete ACTION to follow up the risk. [6 marks] 确定另一个高优先级风险并证明您的答案。 然后推荐一项具体行动来跟进风险。 [6分]

**ANS:**

Another high priority risk for the development of LinKids could be the risk of technical challenges in adapting the existing social network software to meet the specific requirements of CHESS. This risk can be justified by the fact that the software was not originally designed to meet the requirements of CHESS and may require significant customization or development effort to meet the specific needs of the project. 另一个高优先级风险可能是在调整现有社交网络软件以满足国际象棋的特定要求方面的技术挑战风险。 该软件最初并非为满足 CHESS 的要求而设计，并且可能需要大量定制或开发工作才能满足项目的特定需求，因此可以证明这种风险是合理的。

To mitigate this risk, one concrete action that can be taken is to conduct a thorough technical feasibility study before starting the development work. This study should assess the technical challenges involved in adapting the software to meet the specific requirements of CHESS and identify potential technical risks that may arise during the development process. The study can also help to identify any gaps in the existing software that may need to be addressed, such as the need for additional features or functionalities. Based on the results of the feasibility study, appropriate measures can be taken to address the identified technical risks and ensure the successful completion of the project. 为了减轻这种风险，可以采取的一项具体行动是在开始开发工作之前进行彻底的技术可行性研究。 该研究应评估调整软件以满足 CHESS 特定要求所涉及的技术挑战，并确定开发过程中可能出现的潜在技术风险。该研究还可以帮助确定现有软件中可能需要解决的任何差距，例如需要额外的特性或功能。 根据可行性研究的结果，可以采取适当的措施解决已识别的技术风险，确保项目的顺利完成。

**(b) Timothy adopts the IEEE risk management process.**

**(i)** To what extent does the adoption of the IEEE risk management process satisfy the ISO 9001:2015 requirement of applying PDCA to the risk management process? EXPLAIN your answer. [5 marks] 采用 IEEE 风险管理流程在多大程度上满足 ISO 9001:2015 将 PDCA 应用于风险管理流程的要求？

**ANS:**

The IEEE risk management process can be considered to satisfy the ISO 9001:2015 requirement of applying PDCA to the risk management process to a great extent. This is because the IEEE risk management process is structured to follow the PDCA cycle by first planning for risk identification, analysis, and prioritization (Plan), then executing the plan by implementing risk responses (Do), followed by monitoring and reviewing the effectiveness of the responses (Check), and finally, making adjustments or improvements to the process (Act) based on the results of the monitoring and review.

IEEE风险管理流程可以认为在很大程度上满足了ISO 9001:2015将PDCA应用于风险管理流程的要求。 这是因为 IEEE 风险管理流程的结构遵循 PDCA 循环，首先规划风险识别、分析和优先级排序 (Plan)，然后通过实施风险响应 (Do) 来执行计划，然后监控和审查 响应（Check），最后，根据监控和审查的结果对过程（Act）进行调整或改进。

**(ii)** You find it easier to follow the six risk management steps developed by Barry Boehm. If you follow these steps, to what extent does your process conform to the IEEE risk management process? EXPLAIN your answer. [5 marks] 您发现遵循 Barry Boehm 制定的六个风险管理步骤会更容易。 如果您遵循这些步骤，您的流程在多大程度上符合 IEEE 风险管理流程？ 解释你的答案。

**ANS:**

The six risk management steps developed by Barry Boehm, namely Risk Identification, Risk Assessment, Risk Response Development, Risk Response Control, Risk Monitoring, and Risk Communication, align well with the IEEE risk management process, as they cover the same areas of risk management. Therefore, following the six risk management steps developed by Barry Boehm would result in a process that conforms to the IEEE risk management process to a great extent. However, it is worth noting that the exact implementation of the six steps may vary depending on the context of the project, and some adjustments may need to be made to ensure full alignment with the IEEE process.

Barry Boehm 开发的六个风险管理步骤，即风险识别、风险评估、风险响应开发、风险响应控制、风险监控和风险沟通，与 IEEE 风险管理流程保持一致，因为它们涵盖相同的风险管理领域 . 因此，遵循 Barry Boehm 开发的六个风险管理步骤将导致在很大程度上符合 IEEE 风险管理流程的流程。 然而，值得注意的是，这六个步骤的具体实施可能会因项目的上下文而异，并且可能需要进行一些调整以确保与 IEEE 流程完全一致。

# 2021. Question 4.

**(a)** Several process groups are defined in IEEE Standard 12207-2017 Systems and software engineering — Software life cycle processes. In particular, Quality Assurance (QA) belongs to the Technical Management Processes group, while Quality Management (QM) belongs to the Organizational Project-Enabling Processes group.

**(i)** EXPLAIN TWO key differences between the two processes: Quality Management (QM) and Quality Assurance (QA). [4 marks] 解释两个过程之间的两个主要区别：质量管理 (QM) 和质量保证 (QA)

**ANS:**

Quality Management (QM) is focused on establishing the policies, procedures, and objectives necessary to achieve quality, while Quality Assurance (QA) is focused on ensuring that these policies, procedures, and objectives are being followed and that the resulting product or service meets the desired quality standards. 质量管理 (QM) 侧重于建立实现质量所必需的政策、程序和目标，而质量保证 (QA) 侧重于确保遵循这些政策、程序和目标，并确保最终产品 或服务符合所需的质量标准。

**(ii)** Recommend ONE concrete QM or QA action/activity/task for EACH person below that are appropriate to his/her role in MISS. [6 marks]

(1) George

(2) Timothy

(3) You

**ANS:**

**(1) George**: As the General Manager of MISS, George should establish a quality policy that outlines the company's commitment to quality and the specific quality objectives that must be met. This will help to ensure that quality is a priority for the company and that everyone is working towards the same goals. 作为 MISS 的总经理，George 应该制定质量方针，概述公司对质量的承诺以及必须达到的具体质量目标。 这将有助于确保质量是公司的首要任务，并且每个人都朝着相同的目标努力。

As the General Manager of MISS, George can implement a QM activity of conducting regular reviews of project progress and outcomes with the project team to ensure that they are meeting customer needs and requirements. 作为 MISS 的总经理，George 可以实施 QM 活动，与项目团队一起定期审查项目进度和结果，以确保他们满足客户的需求和要求。

**(2) Timothy**: As the Team Leader, Timothy can implement a QA activity of reviewing and verifying the software code developed by the team to ensure that it meets the quality standards set by the company (Participate in peer reviews). This activity will help Timothy to identify any defects or errors in the code early in the development process and ensure that the code is reliable and of high quality. 作为 Team Leader，Timothy 可以实施 QA 活动，审查和验证团队开发的软件代码，以确保其符合公司制定的质量标准。 此活动将帮助 Timothy 在开发过程的早期识别代码中的任何缺陷或错误，并确保代码的可靠性和高质量。

**(3) You**: As a Junior Programmer, one concrete QA action you can take is to perform code reviews on your own work as well as the work of your peers. This can help identify any potential issues early in the development process, which can save time and resources in the long run. 作为一名初级程序员，您可以采取的一项具体 QA 操作是对您自己的工作以及您同事的工作进行代码审查。

**(b) According to ISO/IEC 25010:2011 SQuaRE — System and software quality models, the Quality in Use model defines 5 quality characteristics (requirements) as follows.**

• Effectiveness • Efficiency • Satisfaction • Freedom from risk • Context coverage

**(i)** With respect to the pilot project, suggest what LinKids needs to achieve in terms of THREE of these quality characteristics. [6 marks] 建议 LinKids 需要根据这些质量特征中的三个来实现什么

**ANS:**

**(ii)** Choose any TWO of the quality characteristics that you suggest LinKids to achieve in part (b)(i) above. For EACH of these two, suggest ONE metric or method for assessing LinKids in terms of the extent achievement of the quality characteristic. [4 marks] 选择您在上面 (b)(i) 部分中建议 LinKids 实现的任何两个质量特征。 对于这两个中的每一个，建议一个指标或方法来评估 LinKids 在质量特征的实现程度上。

**ANS:**