

Exam 1 Practical - Solutions

1. List two of the factors that contributed to the "software crisis" in the early history of software development, and explain how software engineering life-cycle approaches attempt to address those factors. 列出 软件开发早期的 导致 “软件危机”的因素，并解释软件工程生命周期试图解决这些因素的方法

Many answers are possible. For example: high cost of maintenance addressed by better documentation, better design for understandability and extensibility, formal reviews, testing procedures, etc; high cost of development addressed by more emphasis on analysis and design before implementation begins; etc. (维护成本 高 解决办法为 更好的文案，对于可理解性，可扩展性更好的设计，正式的评审，测试程序等；开发成本高解决办法为在实现开始前进行更全面的分析与设计)

2. What software life-cycle model would you use if there is significant technical risk and the customer's requirements are not well-known in advance? Justify your answer in a short essay. (如果有重大技术风险和客户的要求是不明确的，你会使用什么软件生命周期模型？在一篇短文中证明你的答案)

Either spiral or rapid prototyping, or a combination of both. Spiral has good risk management characteristics, and can be implemented to include early prototypes or simulations to show to the customer. Rapid prototyping is good for clarifying requirements with the customer, and can be used to put early pressure on components with technical risk. (无论是螺旋 模型 或快速 原型 模型，还是两者的结合 都可以。螺旋 模型 具有良好的风险管理特性，可以实现早期原型或模拟显示给客户。快速 原型 技术 有助于明确客户的真正需求，减少由于软件需求不明确带来的开发风险)

3. The engineers at hypothetical.com adopted the incremental model for the development of their intelligent Web-based search agent. After implementing version 1.0 (which supported basic keyword searching of a list of sites using keyword query) they found that they could not implement version 2.0 (which supports searching using Boolean combinations of keywords) without completely re-designing the query module. Why do you think this problem might have arisen? Suggest two ways that the problem might have been avoided. Justify your answer in a short essay. (工程师 们在 hypothetical.com 工程采用增量模型 用于他们的基于网络的 智能搜索代理的开发。在 实现 1.0 版本（支持基本的关键字搜索的网站，使用关键字查询），他们发现，他们无法实现 2 版本（支持搜索使用布尔组合的关键字）没有完全重新设计的查询模块。你为什么认为这个问题会出现？给出 2 种 该问题可能被避免 的方法。在一篇短文中证明你的答案。)

The problem was probably caused by a lack of detail in the requirements analysis phase, a lack of detail in the design phase, or some combination of both. More attention to detail in these areas could have remedied the problem, assuming that all of the basic functional requirements were known in advance. If the requirements were underspecified and/or not completely known, then a better choice of development model might have been the rapid prototyping model or spiral model. Or, the incremental could have been used after an initial rapid prototype was used as a technique for firming up the requirements. (这个问题很可能是在需求分析阶段缺少细节 或者 在设计阶段缺乏细节，或者是两者的结合。如果在分析，设计阶段，考虑到更多的细节，或许可以纠正这个问题，假设所有的基本功能要求已知。如果要求是未指定的，或者是不完全清楚的，那么开发模式更好的选择可以是快速原型模型、螺旋模型。或者，增量模型可以在经过最初的快速原型模型之后，作为一个坚定的开发技术模型。)

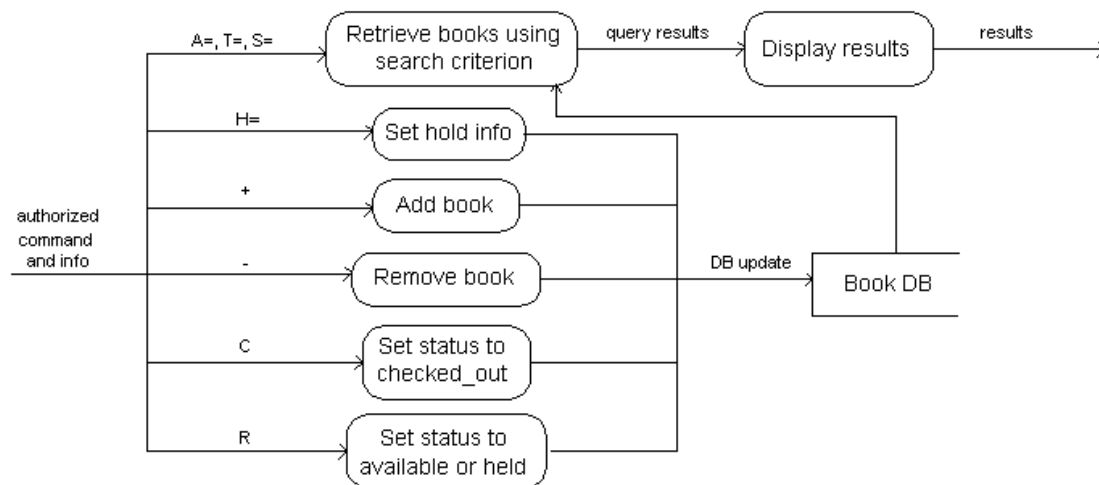
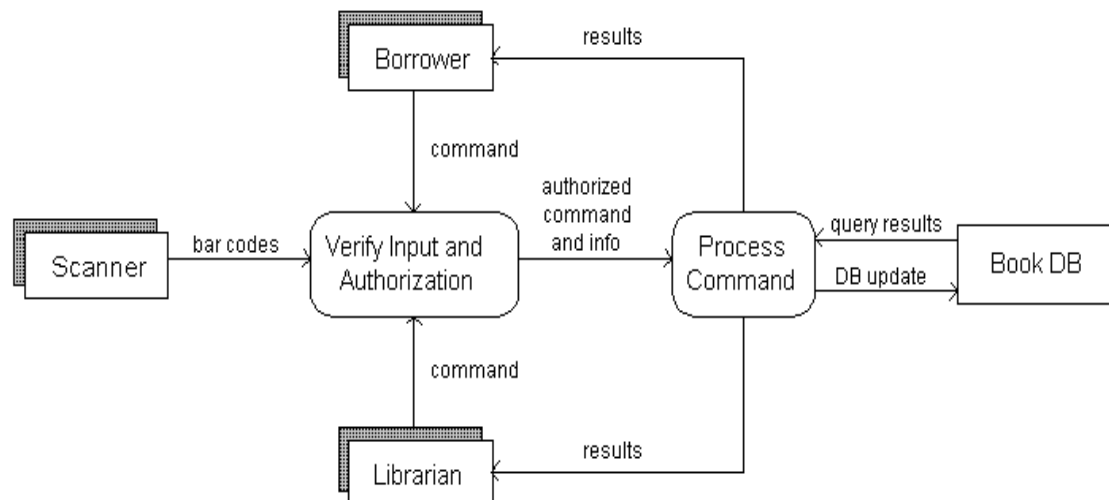
4. Case Study : Consider an automated library circulation system.

- o Every book has a bar code and every borrower has a card bearing a bar code.
- o When a borrower wishes to check out a book, the librarian scans the bar code on the book and on the borrower's card, and then enters C at the computer terminal.
- o When a book is returned, it is again scanned and the librarian enters R.
- o Librarians can add books (+) to the library collection or remove them (-).
- o Borrowers can go to a terminal and determine:
 - all the books in the library by a particular author
(the borrower types A= followed by the author's name)
 - all the books with a specific title
(the borrower types T= followed by the title)
 - all the books in a particular subject area
(the borrower types S= followed by the subject area)
- o If a borrower wants a book that is currently checked out, the librarian can place a hold on the book so that, when it is returned, it will be held for the borrower who requested it
(the librarian types H= followed by the number of the book)

Questions

1. Draw a dataflow diagram for the system, showing as much detail as you can without making assumptions about implementation.

The dataflow diagram for the entire system is shown immediately below. The Process Command process is shown using a hierarchical expansion in the second diagram.

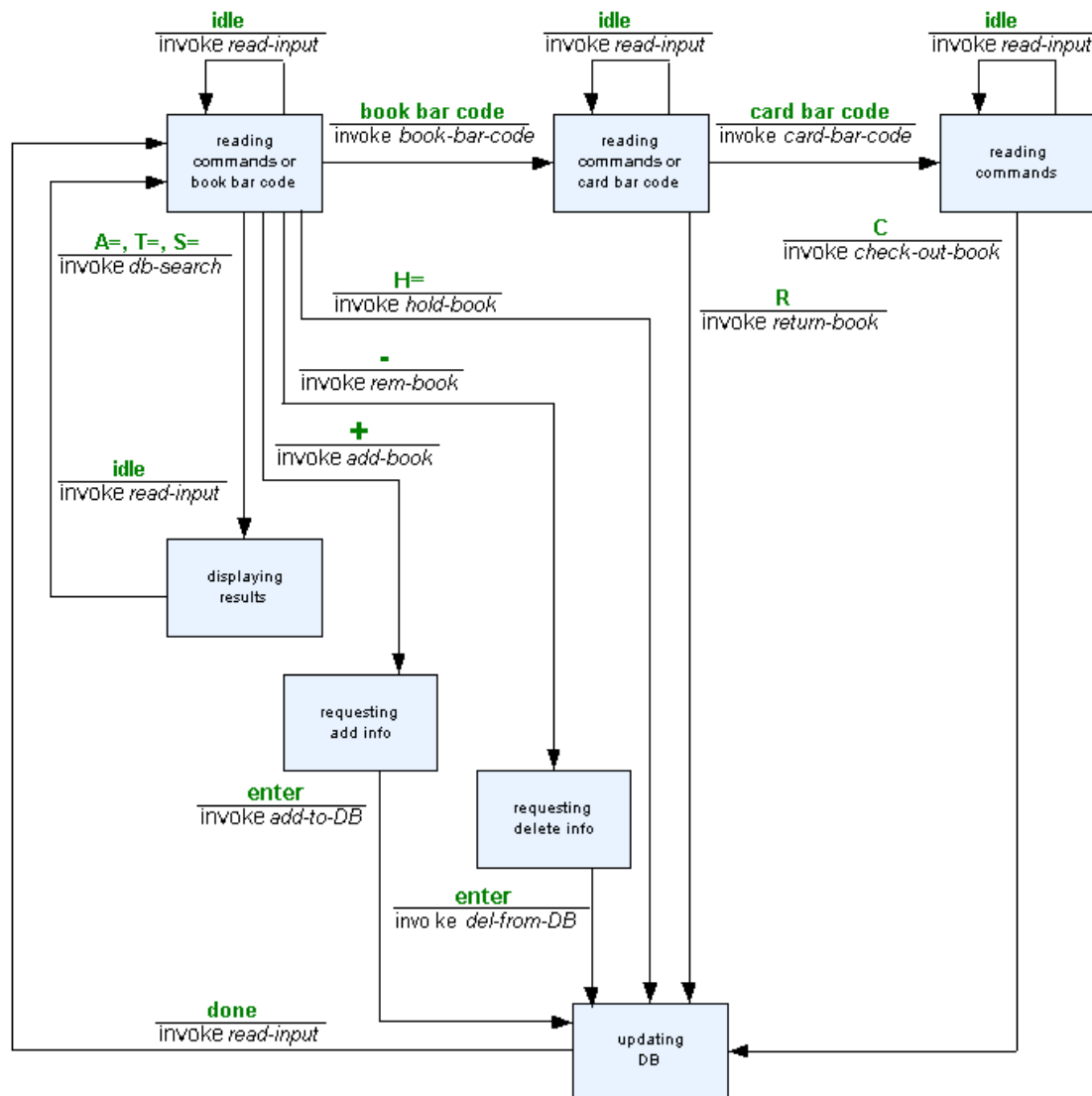


2. Draw a state transition diagram for the system.

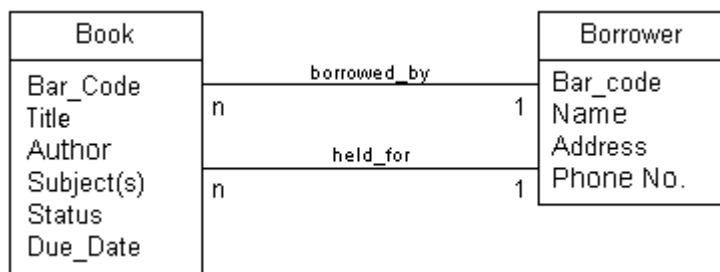
NOTE about the diagram:

- The diagram uses separate states for reading commands and bar codes to show the sequence in which the bar codes and commands are expected.

(状态变迁 图使用单独的状态 用于读取命令与 条形码 来 显 示条形码和命令的时
序。)



3. Draw an entity-relationship diagram for the system.



NOTES about the diagram:

- The Status attribute can take on the values: available , held , checked_out .
- Placing a hold on a book creates an instance of the relation held_for .
- Checking out a book creates an instance of the relation borrowed_by .

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Exam 2 Practical - Solutions

1. Use the technique of noun extraction to identify the possible classes in the following use case scenario for a software system which controls an assembly line: (使用名词提取技术，以 识别 在下列情况下使用的 的 软件系统的可能的类)

"The sensor sends a STOP message to the control software if a widget reaches the end of the conveyor belt without being lifted by the robot arm. The software sends a signal to the motor controller to stop the assembly line." (如果一个小部件到达传送带尾部，但没有被机器人手臂举起，该传感器会发送一个停止消息给控制软件。该软件向电机控制器发送一个信号，以阻止该流水线。)

Which of the candidate classes should not be added to the preliminary class list? Refer explicitly to the refinement principle you used in each case. (候选类中的哪些不应该被添加到预类列表中？在每一种情况下，都要明确你所使用的细化原则。)

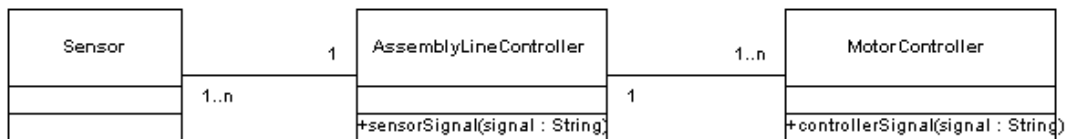
"The sensor sends a STOP message to the control software if a widget reaches the end of the conveyor belt without being lifted by the robot arm . The software sends a signal to the motor controller to stop the assembly line ."

Candidate classes which are eliminated during preliminary class refinement: widget , end , robot arm , control software , assembly line (outside problem scope); STOP message, signal (should be modeled as message or method calls, not as separate classes); also, the pairs of terms (conveyor belt / motor controller) and (software / control software) could be redundant synonyms for each other. The final candidate class list: sensor , motor controller , and assembly line controller . (在初步类细化过程中被淘汰的候选类：小部件，尾部，机器人手臂，控制软件，装配线（淘汰原因是这些属于问题边界以外）；停止消息，信号（应该被模

块化为消息或着是方法调用，不作为单独的类）；另外，成对的术语（传送带/电机控制器）和（软件/控制软件）可能是多余的同义词。最后的候选类列表：传感器，电机控制器和流水线控制器。）

2. Draw an object diagram for the classes you identified in Question 1; be sure to include any class attributes or methods that resulted from preliminary class refinement. (将你在问题 1 中确定的类画一个对象关系图；一定要包含一个类的属性或方法，这些属性或方法都是来源于初始类。)

Here is the associated object diagram:

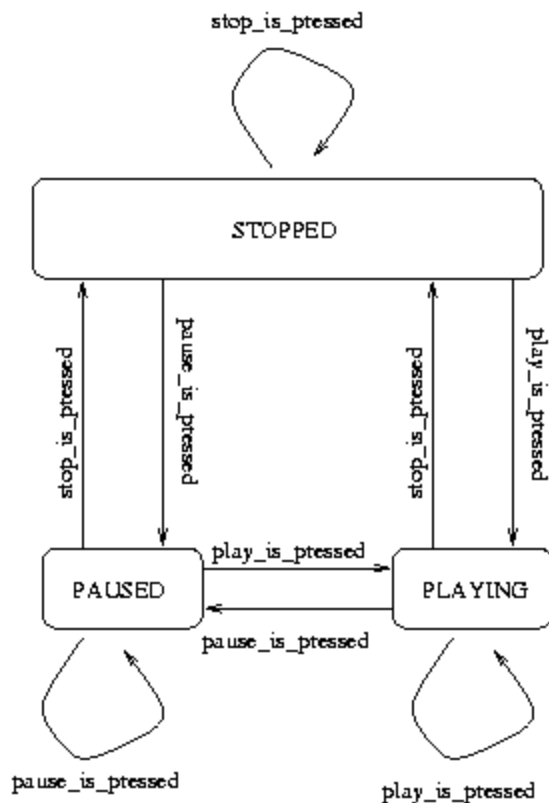


3. Does the object diagram you drew for Question 2 use the principle of responsibility-driven design in the assignment of messages (method calls) to classes? Justify your answer. (问题 2 中你画的 对象图是否有使用责任驱动的设计原则（方法调用）分配给类？证明你的答案。)

Yes. Since the controller objects are responsible for responding (modifying their behavior) based on the sensor signals, those signals (messages) should be implemented as method calls inside the controller objects. (是的.由于控制器对象负责的是基于传感器信号响应（修改他们的行为），这些信号（消息）应在控制器对象的方法调用内部作为方法调用实现。)

4. Draw a UML state transition diagram to model the control program for a portable CD player. Include three states: stopped , playing , and paused . Also, include three events, possible in any state: pause_is_pressed , stop_is_pressed , and play_is_pressed.

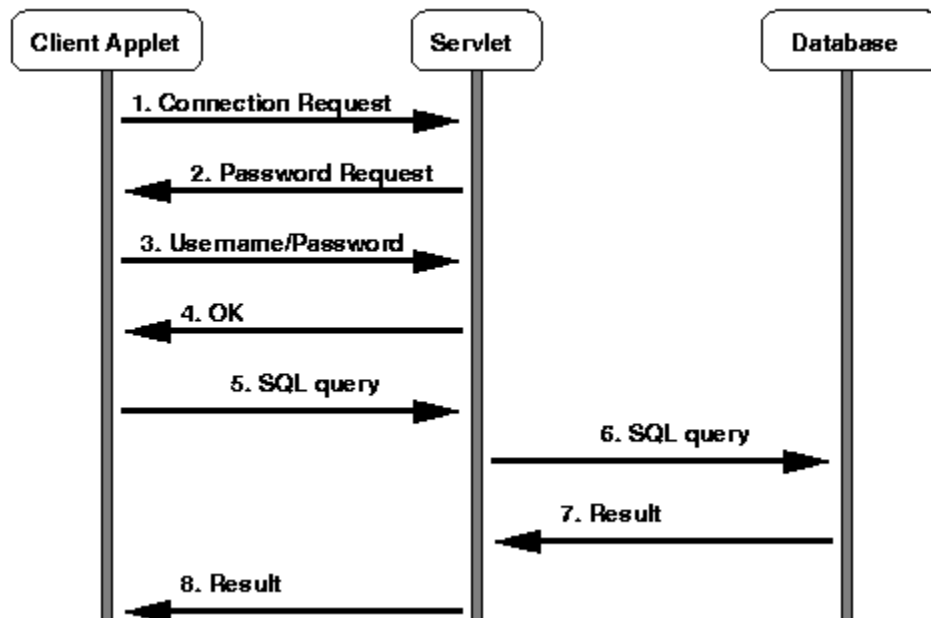
Here is the associated state transition diagram:



5. Draw a UML sequence diagram that models the following events in a three-tier database client-server architecture:

"The client applet sends a connection request to the database servlet, which sends back a password request. The user supplies a username and password, which are sent back to the database servlet. The username and password are correct, so the servlet responds with an 'OK' message. The user enters search parameters in the applet interface, and the client applet translates these to an SQL query, which is sent to the database servlet. The database servlet sends the SQL query to the remote database, which sends back the results of the query. The servlet passes the results back to the client applet." (客户端程序发送一个连接请求给 数据库的 servlet，具体请求是发送一个密码。用户提供了用户名和密码，并退回到数据库 Servlet。用户名和密码是正确的，所以 servlet 响应一个'好'的消息。用户在程序接口输入搜索参数，然后客户端程序将这些参数翻译为 SQL 查询语句，把 SQL 语句发送到数据库的 servlet。数据库 Servlet 把 SQL 查询语句发送到远程数据库，远程数据库将返回查询的结果。这个 servlet 将结果返回给客户程序。")

Here is the associated sequence diagram:



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Exam 3 Practical - Solutions

1. Which of the artifacts in your project system are the most likely candidates for reuse? Justify your answer using the principles of reuse you learned in the course. (你的项目系统中哪些工件是最有可能重用的？用你在课程中学习的原则为你的答案论述。)

Potentially reusable artifacts include code and noncode items (specifications, models, etc.). Hence the wording of the question. The most likely candidates for reuse are the database middleware and the generic aspects of the client applet. The independence (low coupling) and high cohesion of these modules make them good candidates for reuse. The entity-relationship model and backend database model are probably the least reusable in another context, because they are completely dependent on the particular problem to be solved. (潜在的可重用构件包括编码和非编码的项目（规格，模型，等）。因此，问题的答案。最有可能重用的是数据库中间件和客户端程序的一般部分。独立性（低耦合）和高内聚的这些模块，使他们很好的作为重用的候选。实体关系模型和后端数据库模型可能是最不可能重用的，因为它们完全依赖于特定的问题。)

2. Use the technique of boundary value analysis to describe the different equivalence classes of input to the three objects in a three-tier database client-server architecture (client applet, database servlet, database). Use this information to sketch a brief outline for an execution-based test plan for such a system. (使用边界值分析的方法来描述在一个三层的数据库/客户/服务器结构中三个不同的等价类的对象输入 (客户端 Applet、Servlet 数据库, 数据库)。使用此信息为这样一个系统概括出一个以基于执行的测试计划)

Boundary value analysis and equivalence classes (边界值分析与等价类 :)

- o At the client applet: good data from the user, bad data from the user.
- o At the database servlet: valid SQL queries, invalid SQL queries.
- o At the database backend: valid SQL queries, invalid SQL queries

(The student may also mention the control messages that are sent back/forth for things like login, connecting to DB, etc.). (学生还可以提到 控制信息, 发送 / 返回的东西, 如登录, 连接到数据库等。)

A basic execution-based test plan would include two main phases: a phase to verify that all the acceptable input is handled correctly (functional requirements are satisfied), and a phase to verify that all the invalid input is handled gracefully (robustness requirements are satisfied). (一个基本的基于执行的测试计划将包括 2 个主要阶段: 一个阶段, 以验证所有的可接受的输入 可以被 正确处理 (功能的要求是满意的), 和一个阶段, 以验证所有无效的输入处理 得当 (程序健壮 性要求是满意的) 。)

3. Assume that you are a software procurement officer for a company that sells automobiles online, and that you are interested in contracting with a software developer to create a three-tier client-server system for e-commerce like the one you built for your project. It is your job to write a set of acceptance criteria for the contract, based on your idea of what comprises adequate product testing for the system. What kinds of product testing are appropriate in this context? Give examples specific to the three-tier e-commerce system. (假设你是一家在网上销售汽车的公司的软件采购人员, 你很感兴趣与一个软件开发人员创建一个三层的客户端-服务器系统, 为电子商务如你所建的项目。你的工作是写一套接受标准的合同, 根据你的想法, 包括 足够的 产品测试 对于这个 系统。在这种情况下, 什么样的产品测试是适当的? 给出具体的三层电子商务系统。)

The following answers are representative of the types of student answers that are acceptable. Correctness: the system must handle any valid set of input it is given, based on the requirements specification for the system. Reliability: the system must run 24 hours a day, 7 days a week, with a maximum acceptable down time of 10

minutes every 7 days. Robustness: the system must be able to handle at least 100,000 transactions per day, with a maximum allowable burst rate of 100 transactions per minutes. Documentation: the system must include complete documentation for the installer, maintainer, and end user, each of which will be subjected to formal review before acceptance. Installation: the client and server programs will be installed and tested under expected conditions before acceptance. (正确性: 系统必须处理任何有效的输入, 根据系统的需求规范。可靠性: 系统必须每天运行 24 个小时, 每周 7 天, 每 7 天最多可接受 10 分钟。健壮性: 该系统必须能够处理至少 100000 个交易, 每一天, 具有最大允许的 100 个交易每分钟的爆发率。文档: 系统必须包括完整的文件的针对于 安装人员, 维护人员, 和最终用户, 将每个进行正式评审验收。安装: , 客户端和服务程序将安装和测试。)

4. Briefly describe the types of documentation activity during the various life-cycle phases of a software product. (简要地描述软件产品的各个生命周期阶段的文档活动类型)

The answer should include a mention of at least one kind of document/type of documentation activity during each life-cycle phase (requirements, specification, design, implementation, integration, maintenance). More detail should be given for implementation and integration phases. Testing documents should be mentioned. (答案应该包括在每个生命周期阶段 (要求、规范、设计、实施、集成、维护) 中至少一种文件/类型的文档活动的一个提及。更详细的实施和整合阶段 细节也要给出。应提及测试文件。)

Discuss the role of documentation across phases. (讨论跨阶段文档的作用。)

Documentation for the current phase of the current version of the product should be completed before the next phase begins, ideally by the same individuals who worked on the phase. Documentation provides continuity when personnel changes. Accurate documentation is a necessity for product development and maintenance. (为当前版本的产品的当前版本的文档应该在下一个阶段开始前完成, 理想情况下由同一个工作的人进行。当人事变动时, 文档提供连续性。准确的文件是产品开发和维护的必要性。)

If you were a project manager, what would you do in order to ensure that good documentation is available? (如果你是一个项目经理, 你会做什么, 以确保良好的文件是有效的?)

Plan for a thorough documentation process from the beginning. Schedule time in the plan for writing and maintaining the documentation. Remind the client that good documentation is a priority for both sides. Establish or adopt documentation standards and train people in their use. Use processes and/or CASE technology that

facilitate documentation maintenance and make available online the most recent versions of documents to all interested parties. (从一开始就 对 文档 过程有彻底的计划。在计划中 为 编写和维护文档 安排时间。提醒客户，良好的文档是双方的优先事项。建立或采用文件标准，培训人员使用。使用过程和/或案例技术，有助于文档的维护，并将 网上 最新版本的文档提供给所有感兴趣的 当事人。)

5. What is maintenance and are there different kinds of maintenance? What activities does maintenance involve and what skills does it require? Describe the different aspects of managing maintenance including fault reports, CASE technology, and metrics. (什么是维护，有什么不同的维护？维护涉及到哪些活动并且需要哪些技能？描述管理维护的不同方面，包括故障报告，案例技术和指标。)

Maintenance is any changes to a software product after it has been accepted by the client. Students should mention and briefly describe corrective, perfective, and adaptive maintenance. Releases should try not to mix different types of maintenance. Activities may involve changes to any aspect of the product's life cycle, including documentation, and therefore maintainers must have a broad range of skills in addition to good diagnostic skills. (维护是一个软件产品已被客户接受后的，对其做的任何更改。学生应该提及并简要描述和纠正，完善，适应性维护。应尽量不 弄混 不同类型的维护。活动可能涉及更改该产品的生命周期，包括任何方面的文档，因此，维修人员必须除了良好的诊断技能外，有一个广泛的技能。)

Students should talk a bit about managing fault reports (prioritization, workarounds). CASE technology is useful throughout the process, but version-control and configuration-control tools in particular will help keep track of the various versions of a changing product. Fault-tracking systems help with fault management. (学生应该谈一点关于管理的故障报告（优先级、解决方法）。在整个过程中，案例技术是有用的，但是，版本控制和配置控 制工具将有助于跟踪不断变化的产品的各种版本。故障跟踪系统有助于故障管理。)

Useful metrics are:

1. number of faults found in total and in a given period
2. a classification of faults
3. the status of faults (有用的指标是：1、总的故障数和给定时间内的故障数
2、故障分类 3、故障状态)

Other questions:

List out the advantages and disadvantages of water fall model.

Outline the factors affecting the quality assurance activities.

Why review team should not consist of many members? Justify your answer.

List out the advantages and disadvantages of spiral model.

List out the activities needed for SQA

Define testing. Define Test case

What are 4Ps?

List the advantages of Automation Testing.