# 西 安 电 子 科 技 大 学

## 考试时间___120___分钟

# 试　　题

| 题号 | 一 | 二 | 三 | 总分 |
|------|-----|-----|-----|------|
| 分数 |     |     |     |      |

1.考试形式：闭卷☑　开卷□

2.考试日期：　　年　　月　　日(答题内容请写在装订线外)

## 一、简答题（第 1 小题 4 分，第 2 小题 6 分，共 10 分）

1. According to your understanding, please describe what software architecture is.

根据 1993 年软件体系结构的定义，可以认为软件体系结构主要包括三个要素：组件，
连接件，约束。下面分别介绍三个要素：
组件：系统中具有一定功能的可重用的软件模块单元，主要在系统中负责数据计算以及
数据存储功能。
连接件：连接件用于组件之间的交互，简单的连接件包含管道，过程调用等；复杂的连
接件包括客户端服务器通信协议，系统与数据库之间的 sql 连接。
约束：组件与连接件之间的拓扑结构以及约束。

2. Please describe the "blackboard" architecture style and point out its advantages and disadvantages.

黑板架构风格属于以数据为中心的架构风格中的一种，其结构由黑板，知识源，控制器
组成，其中黑板主要包括问题求解状态（解空间），知识源包括求解问题的各种策略，控制
器用于监控黑板的状态，当黑板状态发生改变时，控制器获取当前黑板状态，并相应的知识
源，提取问题的求解策略，然后知识源作用于黑板结构改变当前问题求解状态。
优点：
● 易于系统的扩展和维护：知识源和黑板结构相互独立，因此对于系统可以很轻易的
在知识库中更新知识源，增添新的知识源，使得系统得到扩展和维护。
● 将问题分解为子问题，然后不断求解：黑板结构将一个复杂的问题分解为一个个小
子问题，使得问题易于求解。
● 易于软件重用：对于已有的知识源，通过其接口，可以将其复用于其他软件。
缺点：
● 性能低：黑板结构无法并发执行功能，因此计算效率低，系统性能差。
● 可测试性差：对于黑板风格，无法知道问题求解策略是否正确与否，因此对于系统
的可测试性来说较差。
● 无法验证是否拥有正确求解的存在：对于一个复杂的问题，黑板结构无法的值是否
拥有一种存在的解使得问题可以解决。

## 二、单项选择题（每小题 4 分，共 20 分）

1. Which of the following tactic can be used to achieve the <u>security</u>?
(A) Information hiding　　　　　　(B) Implicit invocation
(C) Removal from service　　　　　(D) Limit exposure

[ D ]

2. Which of the following tactic can be used to achieve the <u>availability</u>?
(A) Hide information　　　　　　　(B) Heartbeat
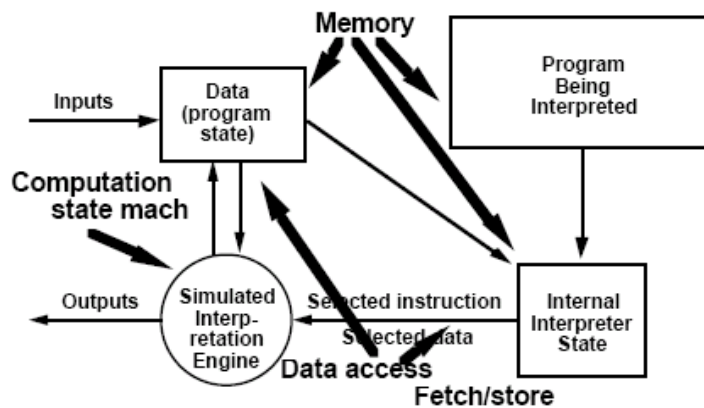(C) Scheduling policy　　　　　　　(D) Introduce concurrency

[ B ]

3. Which of the following tactic can be used to achieve the <u>performance</u>?
(A) Prevent ripple effects          (B) Limit exposure
(C) Manage event rate               (D) Process communication

[ C ]
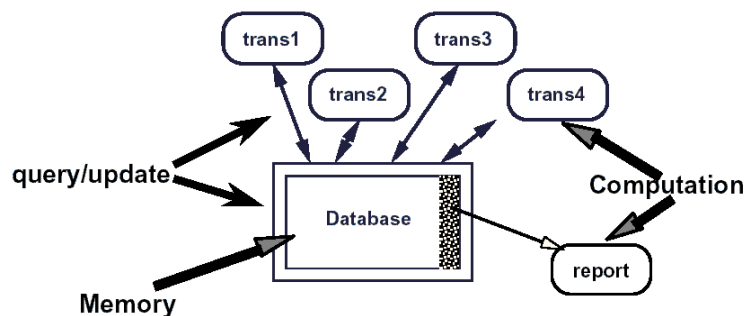
4. Which architecture style does the following diagram describe?



(A) Process control          (B) Interpreter
(C) Blackboard               (D) batch sequential

[ B ]

5. Which architecture style does the following diagram describe?



(A) Blackboard               (B) Repository
(C) Implicit invocation      (D) Layered

[ B ]

## 三、问答题(第 1 小题 38 分，第 2 小题 16 分，第 3 小题 16 分，共 70 分)

1、Quality Attribute and Architecture Style

A company plans to develop a software system for a specific kind of sweeping (扫地) robots. The system will control such a robot to move around and clean up the

indoor floor. A robot is designed to move in a room randomly. When the robot detects a rubbish (垃圾), it is supposed to gather the rubbish and continue to repeat such a step. If an obstacle (障碍物) blocks in its way, the robot should be able to bypass (绕过) the obstacle and move on. This software system is composed of several modules, containing sensor component, walking component, cleaning component, user interface and so on. The core module receives the information from sensor, and then controls walking and cleaning modules to execute tasks. The user interface of the system is in charge of giving operation orders and displaying the current state.

反互. Following are some detailed requirements of this system.

(1) A robot may encounter (遭遇) a malfunction (故障) during working. The average recovery time should be less than 5 minutes.

(2) The system could be accessed remotely. Only authorized user can sign in and control and robot.

(3) The robot will be tested in real environment. The system should provide specific interfaces for this.

(4) When a sensor in the robot is changed, the corresponding software component should be updated by 2 developers within 3 days.

(5) Given a room within 20 square meters broad, the robot is required to sweep it in less than 1 hour.

(6) The user interface is required to be simple and friendly as far as possible.

分析上面的需求，回答下面 4 个问题——

问题一：Identify the related quality attributes according to the requirements.

| 需求编号 | 对应的 Q A | 需求编号 | 对应的 Q A |
|---|---|---|---|
| （1） | 可用性 | （4） | 可修改性 |
| （2） | 安全性 | （5） | 性能 |
| （3） | 可测试性 | （6） | 易用性 |

问题二：For each quality attribute, give the corresponding quality attribute scenario.

| | Availability | Modifiability |
|---|---|---|
| Source | 外部或内部故障 | 开发人员 |
| Stimulus | 系统发生故障 | 对机器人传感器进行修改 |
| Artifact | 机器人系统 | 系统传感类 |
| Environment | 在系统正常工作情况下 | 在系统维护期间 |

| | | |
|---|---|---|
| Response | 系统进行故障修复 | 系统感知模块组件并重新创建 |
| Response measure | 修复时间小于5min | 2名开发人员在3天内完成关机 |

| | Performance | Security |
|---|---|---|
| Source | 网络访问瞬间 | Authorized user |
| Stimulus | 访问中的访问延迟降符 | sign in and control [robot] |
| Artifact | 机器人系统 | system |
| Environment | 机器人正常运行 | 系统正常运行 |
| Response | 机器人对访问进行扫描 | 对授权用户 |
| Response measure | 障碍物避开 1 hour 清理完垃圾 | 系统返回连接成功，排接权造成失败，防止非法用户连接 |

| | Testability | Usability |
|---|---|---|
| Source | 测试人员 | 用户 |
| Stimulus | 对机器人进行测试 | 用户接口使用 |
| Artifact | 机器人系统 | 系统用户接口 |
| Environment | 系统测试期间真实动作 | 系统正常运行 |
| Response | 系统提供特殊接口进行测试 | 用户接口正常使用 |
| Response measure | 测试成功找到 bug | 用户使用接口简单友好 |

问题 3：For each quality attribute, list at least 2 tactics for archiving the corresponding quality attribute.

| QA | tactics |
|---|---|
| Availability | |
| Modifiability | |
| Performance | |
| Security | |
| Testability | |
| Usability | |

问题 4：According to the requirements, which software architecture style is better for this system? Describe the reason and list the advantages and disadvantages of architecture style you choose for the system.

2、构建 Utility Tree

A software company plans to develop an intelligent video surveillance system（智能视频监控系统）. The development team analyzed the Quality Attributes, designed architecture and wanted to use Utility Tree to evaluate the architecture, followings are the scenarios.

(1)  A request to deliver real time video must be responded less than 3s.  *性能*

(2)  Power outage（断电） at site 1 requires traffic redirect to site 3 in less than 5 minutes.  *可用性*

(3)  An authentication（认证） server should be deployed to support real name authentication.  *安全性*

(4)  Adding a middleware to system must be less than 10 person months.  *可修改性*

(5)  Minimize storage latency on video DB to 300ms.  *性能*

(6)  Customer authorization（授权）database works 99.99% of the time.  *安全性*

(7)  Change Web user interface to a flat UI style must be less than 10 person weeks.  *易修改性*

(8)  The development of a new Android client must be less than 2 person weeks.

(9)  Network failure is detected and recovered in < 1.5min  *可用性*

*可移植性*

According the scenarios, please construct a Utility Tree.

3、Architecture Evaluation

Identify and record risks and non-risks, sensitivity points and tradeoffs is an important task in architecture evaluation.

:

问题1：Describe the definitions of risk, non-risk, sensitivity point and tradeoffs

问题2：Read the following descriptions and point out each description is a risks, non-risks, sensitivity points or tradeoffs.

(1) There is no way of detecting the failure of the communication line between server and clients.
(2) The number of simultaneous connections will significantly affect the number of transactions a database can process per second.
(3) Changing the algorithm of encryption could have an impact on both security and performance.
(4) The data sampling rate is once per second, and the processing time is less than 30ms.
(5) Discount policy for VIP is not clearly described. This could result in replication of functionality.
(6) A system with high modularity might have low portability and performance.

| | 描述编号（1-6） |
|---|---|
| Risks | (1) (5) |
| Non-risks | (4) |
| Sensivity points | (2) |
| Tradeoffs | (3) (6) |