

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：2020 年 8 月 18 日(答题内容请写在装订线外)

Note: Write all answers on the answer sheet.

软件体系结构 = 组件 + 连接件 + 约束

Question 1: Explanations (10 points)

Software Architecture = Components + Connectors + Constrains

- 1) According to your understanding, please describe what software architecture is.
 组件、连接件、约束
- 2) Please describe the "virtual machine" architecture style, and give one typical application scenario.
 解释器、

Virtual Machine包括Interpreter和Rule-based。如javascript，配置文件等需要解释的语言都由解释器风格的软件进行解释；如果业务逻辑需要频繁变化的话，则可以使用Rule-based风格。此时，为了让固定的逻辑能够理解变化的规则，我们还需要在中间插入一个规则引擎。比如淘宝平台的打折促销，力度经常会改变，这部分就作为规则，而不变的是使用这些规则去进行价格计算的逻辑。

Question 2: Multiple Choice (单项选择题) (20 points)

1. Which of the following tactic cannot be used to achieve the Availability?

- A) Heartbeat
- B) Semantic coherence
- C) Passive redundancy
- D) Active redundancy

2. Which of the following tactic can be used to achieve the Modifiability?

- A) Process monitor
- B) Authenticate users
- C) Semantic coherence
- D) Built-in monitors

3. Which of the following tactic can be used to achieve the Performance?

- A) Ping/echo
- B) Limit access
- C) Use an intermediary
- D) Fixed-priority scheduling

4. Which of the following tactic can be used to achieve the Security?

- A) Ping/echo
- B) Authenticate users
- C) Use an intermediary
- D) Removal from service

5. Which of the following tactic can be used to achieve the Testability?

- A) Maintain data confidentiality
- B) Record/playback
- C) Heartbeat
- D) Rollback

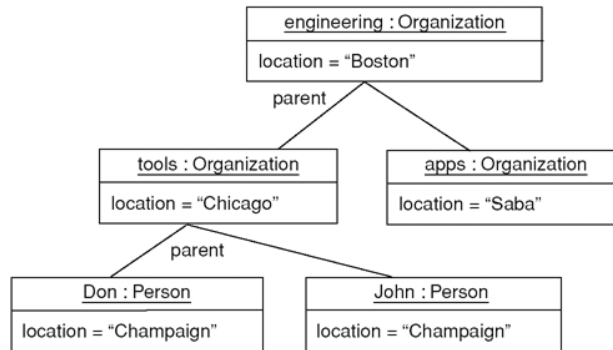
6. Which diagram is suitable to represent an external view of a system?

- A) Use case diagram
- B) Deployment diagram

C) Activity diagram

D) Interaction overview diagram

7. Which kind of diagram is the following diagram?



A) Class diagram

B) Component diagram

C) Object diagram

D) Sequence diagram

8. Which diagram is suitable to show the **interactions** between objects?

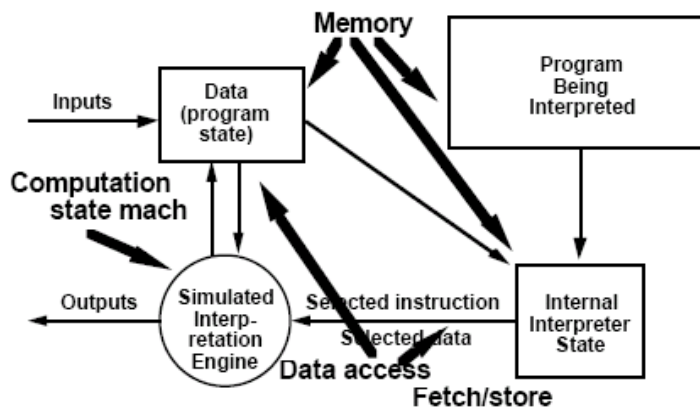
A) Sequence diagram

B) Use case diagram

C) Activity diagram

D) State diagram

9. Which architecture style does the following diagram describe?



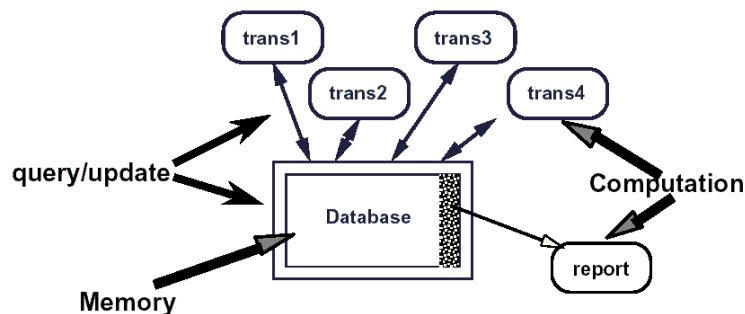
A) Process control

B) Interpreter

C) Blackboard

D) batch sequential

10. Which architecture style does the following diagram describe?



A) Blackboard

B) Repository

C) Implicit invocation

D) Layered

Question 3: Architecture Analysis and Design (70 points)

1. Quality Attribute and Architecture Style (34 points)

A software company plans to develop a Supermarket Member Management System (short for SMMS) for a membership-based (会员制) supermarket. The membership-based supermarket means that only members can consume in this supermarket. One of the most important functionality of SMMS is to calculate the discount for each product according to a member level and records of her/his consumption(消费). There are three different member levels in the supermarket, as silver, gold and platinum. Meanwhile, the member level will be extended in the future. Besides, the way to calculate discount may change from time to time.

Followings are some detailed requirements for SMMS system.

- 7. 可测试 a) *The SMMS should not be accessible remotely to updating without internal protocols.* Security
- 可修改 b) *The code coverage of SMMS should be bigger than 70%.* Testability
- 可修改 c) *If a develop wishes to change the UI at development time, the change must be made with no effects in 2 days.* Modifiability
- 可用性 d) *When an unanticipated message from external arrives in SMMS under normal operations of the system, the operator(操作人员) must be informed and she/he can continue to operate without downtime.* Availability
- 性能 e) *When a member initiates (发起) normal operations of SMMS, the transaction must be processed with average latency of one second.* Performance
- 易用性 f) *The SMMS should have a friendly look-and-feel (外观), so it is easy for members to accomplish a desired task in PC, Mobile Phone and Tablet.* Usability
- 安全性 g) *When an authorized member tries to modify her profile under normal operations of SMMS, the system should maintain an audit trail and the modified data is restored.* Security

Please analyze the requirements and complete following 4 questions:

- 1) Identify and name the related quality attributes according to the requirements.
- 2) For each quality attribute, give the corresponding quality attribute scenario. 6个
- 3) For each quality attribute, list at least 2 solutions for archiving the corresponding quality attribute.
- 4) According to the requirements, which software architecture style is better for the SMMS? Describe the reason and list the advantages and disadvantages of architecture style you choose for the SMMS.

规则系统、规则在改、应该抽取规则、而不是抽取数据

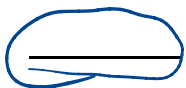
优：逻辑与数据分离

缺：规则不透明。

- 系统庞大，业务复杂
- 业务规则经常改变
- 24小时服务
- 业务统一管理
- 降低系统维护升级成本

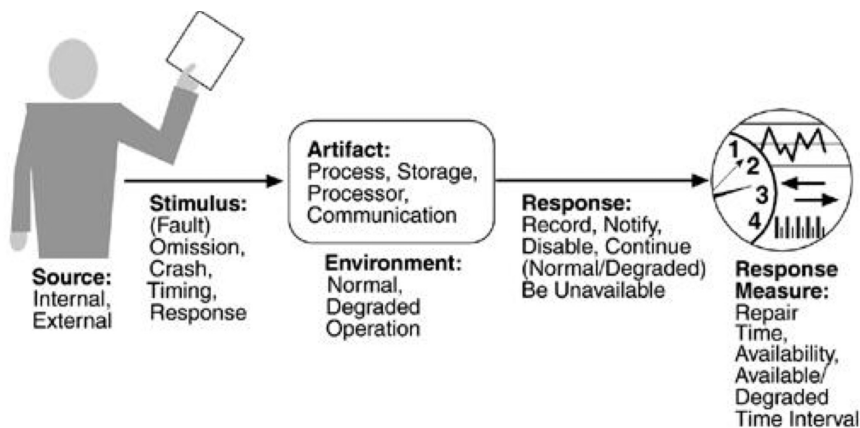
- 声明式编程
 - 规则引擎允许你说“做什么”，而不是“怎样去做”
- 规则系统能解决非常困难的难题
- 逻辑和数据分离
- 快捷和灵活
- 知识集中化
- 工具集成
- 良好的解释机制
- 易于理解的规则

- a) *There are two roles in the system: administrator and user. An administrator can create one or more users, and grant them the permissions accordingly.*
- b) *Users are identified by their mobile phone numbers, and they can set a nickname having least 5 characters starting with letters.*
- c) *The cost for adding a new data processing algorithm to the system by a developer is less than 10-person days.*
- d) *The processing latency on main database need to be reduced to 100ms.*
- e) *Change Web user interface in <3-person weeks.*
- f) *The application can display the processing results for an authentication user, and the authentication works 99.99% of the time.*
- g) *When power outage happens at site 1, it takes at most 3s to redirect all traffic from site 1 to site 3.*
- h) *If a user forgets his password, he can reset his password by receiving a message from the system.*
- i) *The latency for processing a 1GB video data (1080p) must be less than 10s.*
- j) *The network failure can be detected automatically and recovered in < 2.5 min.*
- k) *The system must have a user authorization database to record the user permissions, and the authorization works 99.99% of the time*



- a) *The number of concurrent requests will affect the number of transactions a database can process per second. S, R, 影响性能*
- b) *Changing the level of authentication could have a significant impact on both security and performance. T, 影响性能和安全*

- R** c) *Some business processing component is provided by a third-party company, there is no way of detecting the failure of them directly.*
- N** d) *Assuming the request arrival rate is twice per second, and the average processing time is less than 80ms; a 1 second response time seems reasonable for our system.* **N**
- R** e) *Some of the legacy data processing components are implemented by the C++ programming language, which should be encapsulated (封装) first and are hard for a Java program to maintain and modify them.* **R**
- S** f) *The selection of the encryption algorithm might be closely related to the number of bits of encryption.* **S, R影响安全**



Risk：可能会导致风险的决策或需求；

Non-risk：经过证明可以让系统正常工作的需求；

Sensitivity：会影响一个特定的质量属性，能得到它响应的需求；

Tradeoff：影响多个质量属性的需求。