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(请将答案写在答题纸上).

Question 1: Explanations (10 points)

1) **According to your understanding, please describe what software architecture is.**
2) **Please describe the "virtual machine" architecture style, and give one typical application scenario.**

Question 2: Multiple Choice（单项选择）(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

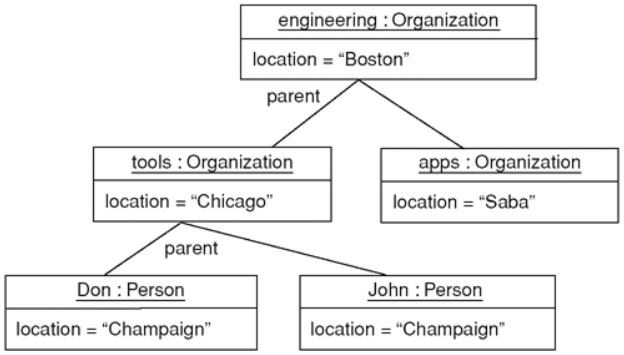
C) Heartbeat　　D) Rollback

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**

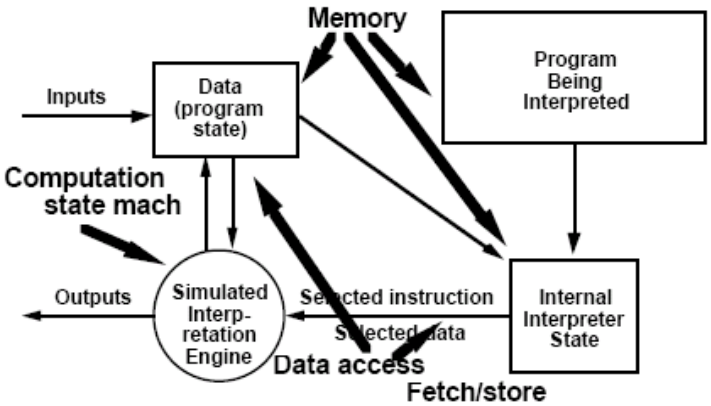
C) Object diagram **D) Sequence diagram**

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

A) Sequence diagram **B) Use case diagram**

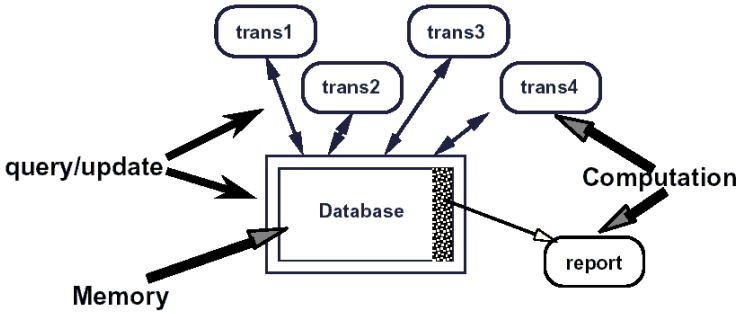
C) Activity diagram **D) State diagram**

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.

a) The SMMS should not be accessible remotely to updating without internal protocols.

b) The code coverage of SMMS should be bigger than 70%.

c) If a develop wishes to change the UI at development time, the change must be made with no effects in 2 days.

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.

e) When a member initiates（发起）a "purchase order" transaction under normal operations of SMMS, the transaction must be processed with average latency of one second.

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.

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.

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.

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.

2. Utility Tree (16 points)

A software company plans to develop a data processing system. The development team analyzed the Quality Attributes, designed architecture and wanted to use Utility Tree to evaluate the architecture, followings are the scenarios.

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 outrage 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.***

According the scenarios, please <u>construct a Utility Tree</u>.

3. Architecture Evaluation (20 points)

Identifying and recording risks and non-risks, sensitivity points and tradeoffs are important tasks in architecture evaluation. Please <u>describe the definitions</u> of risk, non-risk, sensitivity point and tradeoffs and then read the following descriptions and <u>point out</u> each description is a risk, non-risk, sensitivity point or tradeoff.

a) ***The number of concurrent requests will affect the number of transactions a database can process per second.***
b) ***Changing the level of authentication could have a significant impact on both security and performance.***

c) Some business processing component is provided by a third-party company, there is no way of detecting the failure of them directly.

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.

e) Some of the legacy data processing components are implemented by the C++ programming language, which should be encapsulated (封裝) first and are hard for a Java program to maintain and modify them.

f) The selection of the encryption algorithm might be closely related to the number of bits of encryption.