

NAME OF STUDENT :STUDENT NUMBER :

SUBJECT/VAK

THEORY TECHNICAL PROGRAMMING 3

DATE/DATUM

7th June 2011

TIME/TYD

2 HOURS



Cape Peninsula
University of Technology

FACULTY OF INFORMATICS AND DESIGN

COURSE(S): ND: INFORMATION TECHNOLOGY FULL TIME

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INTERNAL MODERATOR : MR K NAIDOO
EXTERNAL MODERATOR : MR C KABUYA

SPECIAL INSTRUCTIONS/SPEZIALE INSTRUKSIES

This Test is not an open Book Exam
There are three sections in this paper and answer ALL sections
Write your ALL YOUR answers in the ANSWER BOOK provided
Both question paper and answer book should be handed back to the invigilator
ALL cell phones should be switched off. Even Silent mode is not allowed.

REQUIREMENTS/BENODIGDHEDE

None.

SECTION A

This section has 10 questions and each question carries 1 mark

1. In choosing how to model server-side components in a system design as layers or tiers, what best describes the relationship between the different tiers or layers?
A. Inheritance.
B. Separation of concerns.
C. Common re-use principle.
D. Scalability.
2. You have been asked to recommend an integration mechanism for two systems, A and B, but only A is written in Java. What do you recommend?
A. Web services
B. Java Connector Architecture (JCA)
C. FTP
D. Session beans

3. Consider the following statements about the two different Web authentication Techniques:

Statement A: HTTP basic – The developer controls the look and feel of the authentication process by supplying HTML forms.

Statement B: Form-based – The web browser prompts the user for a user name and password, and supplies this information in the request header.

Which of the following is applicable for the above?

- A. Both Statement A and B are true
B. Both Statement A and B are false
C. Statement A is true and Statement B is false
D. Statement A is false and Statement B is true
 4. Which of the following REST Web Service method provides a way to determine when a resource was last modified
A. POST
B. GET
C. HEAD
D. OPTIONS
E. UPDATE
-

5. Consider the following description of one of the transaction attributes used in Transactions:

The Tx attribute indicates that the method needs to be executed within a transaction. When a method with the Tx transaction attribute is called in the context of an existing transaction, it becomes a part of the ongoing transaction. If no transaction exists, then server container starts a new transaction before starting the execution of the method and ends the transaction on completion of the bean method.

Which of the following Transaction attribute can be replaced with Tx in the above description of the Transaction Attribute?

- A. Required
- B. RequiresNew
- C. Mandatory
- D. Supports

6. Which of the following IS NOT a benefits of Server Clustering?

- A. Replication
- B. Easy Manageability
- C. Load Balancing
- D. Fault Tolerance

7. HTTPS is defined as

- A. HTTP with Security
 - B. HTTP on secure line
 - C. HTTP over SSL
 - D. HTTP with SSL
-

8. Compact Computers is a small computer assembly company. Their online application allows customers to pick and choose accessories to build their own PCs.

The accessories are:

i.Processor -800Mhz, 1Ghz, 1.2Ghz

ii. HDD - 40 GB, 60 GB, 80 GB

iii. Memory -128 MB, 256 MB, 512 MB

If a computer can have exactly 1 processor, 1 HDD and 1 memory stick, what pattern would be best used here?

- A. Factory Method
- B. Builder
- C. Prototype
- D. Abstract Factory
- E. Singleton

9. You are creating a web application for an online product ordering system. You have decided to use connection pooling to reduce load on the databases. Since you have many databases, you want to create one pool instance of the ConnectionPool class for each database. Depending on what is requested, you may have to connect to a variable number of databases. What pattern should you use?

- A. Factory Method
- B. Builder
- C. Prototype
- D. Abstract Factory
- E. Singleton

10. You have had enough with all the UML tools on the market as none do exactly what you want them to. So you've decided to design your own. However when designing it you realize that certain parts will be really complicated for example you have a Diagram object that is made up of lots of other objects. This diagram object can be used for a variety of different diagrams including class and sequence diagrams. When you create it you only want to specify its type and content. What pattern should you use?

- A. Abstract Factory
 - B. Factory Method
 - C. Builder
 - D. Decorator
-

--END OF SECTION A--

SECTION B (30 marks)

This section has 15 questions and each question carries 2 marks

1. One of the core software design principles states that Software entities (classes, modules, functions, etc.) should be open for extension but closed for modification. This principle is called OCP. Name two Design Patterns that enforce OCP?

-Template Method
-Strategy

2. Which Design principles are Stated formally as :

(i) If for each object o1 of type S there is an object o2 of type T such that for all programs P defined in terms of T, the behaviour of P is unchanged when o1 is substituted for o2 then S is a subtype of T.

The Liskovs Substitution Principle (LSP).

and

(ii) For an operation O on a class C, only operations on the following objects should be called: itself, its parameters, objects it creates, or its contained instance objects.

Principle of Least Knowledge (PLK)

3. The Dependency Inversion Principle (DIP) formalizes the concept of abstract coupling. What is abstract coupling and what is its significance in software design?

Abstract coupling is the notion that a class is not coupled to another concrete class or class that can be instantiated. Instead, the class is coupled to other base, or abstract, classes.

Tightly coupled classes can not work independent of each other

4. Domain-driven design (DDD) flows from the premise that the heart of software development is knowledge of the subject matter and finding useful ways of understanding that subject matter. In DDD terms what is meant by Ubiquitous Language and context mapping.

Same naming convention of domain problem artefacts by all stakeholders involved in the development of an application.

5. In Domain-driven design (DDD), what is the difference between **Entity Objects** and **Value Objects**

Object with Identity and independent life cycle creation and deletion
Object without identity and their life depends on Entity Objects

6. Explain these Terms in Domain-driven design (DDD): **Aggregates and Factories**.

An Aggregate is a cluster of associated objects that we treat as a unit for the purpose of

data changes.

Factories are key elements in the domain layer that manage the creation of complex domain objects.

7. The motto of Test-Driven Development is RED, GREEN, REFACTOR. Explain what is meant by **RED** and **REFACTOR**

RED : Create a test and make it fail.

REFACTOR: Change the code to remove duplication in your project and to improve the design while ensuring that all tests still pass.

8. Continuous integration (CI) is a set of practices intended to ease and stabilize the process of creating software builds. List two challenges that CI assists development teams.

ANY TWO OF THESE

-Software build automation:

-Continuous automated build verification:

-Continuous automated build testing:

-Post-build procedure automation:

9. The core mission of a version control system is to enable collaborative editing and sharing of data. List two strategies used to implement this.

-The Lock-Modify-Unlock Solution

-The Copy-Modify-Merge Solution

10. List two HTTP methods that do the function of reading and deleting a web resource in a **REST** based web services application.

-GET

-DELETE

11. Switch statements (or their equivalent, *ifelseifelseif* structures) are not inherently bad. They become bad only when they make your design more complicated or rigid than it needs to be. In that case, it is best to refactor away from switch statements to a more object-based or polymorphic solution. Which two design patterns can be used to address the issue above?

Any Two of these

-Strategy

-Chain of responsibility

-Command

-Visitor

12. List four participants, as defined by GOF, of a FACTORY METHOD Design pattern.

-Product Interface

-concrete Product

-Creator Interface

-Concrete Creator

13. Duplicated code is the most pervasive and biggest problem in software. It tends to be either explicit or subtle. If the constructors of a class contain duplicated code, what design pattern can you use to remove duplicate code and explain how you would archive this.

-Builder Pattern.

-Use Builder Pattern. to chain constructors

14. In REST web services what does the acronym HATEOAS stand for and what is meant by the principle “Communicate Statelessly”

-HATEOAS=Hypermedia As The Engine Of Application State

-In REST, stateless means that there is no client session data stored on the server. The server only records and manages the state of the resources it exposes.

15. What is the OPTIONS and the HEAD methods used for in REST web Services?

OPTIONS- used to request information about the communication options of the resource you are interested in.

HEAD-Like GET except that instead of returning a response body, it returns only a response code and any headers associated with the request.

--END OF SECITION B—

SECTION C: (50 Marks)

This section has 5 questions and each question carries 10 marks

Question 1:

a) There are three major features in object-oriented programming. One of them is Encapsulation. Encapsulation refers to the creation of self-contained modules that bind processing functions to the data.

i. Name AND define the other two features

-Inheritance passes "knowledge" down.

-Polymorphism takes any shape.

(2 marks)

ii. One of the features in (i) conflicts with encapsulation. Name the feature and describe an alternative option available to a software designer who wants to avoid this conflict.

-Inheritance

-favour composition over inheritance

(2 marks)

b) The Law of Demeter is one of the core principles of design in software

i. Give one primary advantage and one primary disadvantage

-The primary benefit is that the calling method doesn't need to understand the structural makeup of the object it's invoking methods upon.

-The obvious disadvantage associated with PLK is that we must create many methods that only forward method calls to the containing classes internal components. This can contribute to a large and cumbersome public interface.

(2 marks)

ii. Suggest an alternative to the Law of Demeter

Obtain a reference to an object via a method call,

(1 mark)

c) In Software Design, the following three principles govern package coupling and help us determine how packages should deal with the relationships between components and how they should be packaged.

For each principle, give a one line definition of each principle.

(3 marks)

i. The Acyclic Dependencies Principle (ADP)-The dependencies between packages must form no cycles.

ii. The Stable-Dependencies Principle (SDP)-Depend in the direction of stability.

iii. The Stable-Abstractions Principle (SAP)-Stable packages should be abstract packages.

Question 2:

Enterprise applications consist of components that can contain both protected and unprotected resources. Often, you need to protect resources to ensure that only authorized users have access.

- a) Explain what the following terms mean: **Authorisation**, **Authetication** and **Non-Repudiation**

-The means by which communicating entities prove to one another that they are acting on behalf of specific identities that are authorized for access.

-The means by which interactions with resources are limited to collections of users or programs for the purpose of enforcing integrity, confidentiality, or availability constraints.

-The means used to prove that a user performed some action such that the user cannot reasonably deny having done so.

(3 marks)

- b) Name 3 security characteristics that the establishment of a Secure Connection Using SSL guarantees

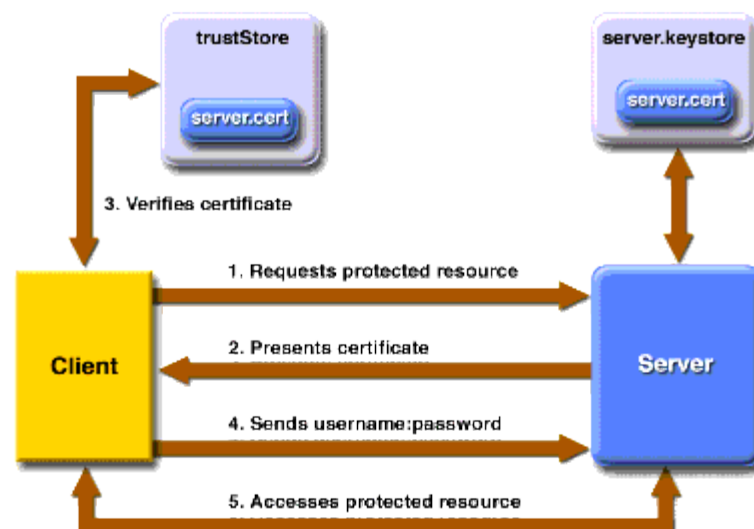
-Authetication

-Integrity

-Confidentiality

(3 marks)

- c) Client certificate authentication is a system widely used on the internet to set-up a secure channel . It requires a request for information from the server, and a response from the browser, to negotiate a trusted authentication relationship between the user (and their browser) and the server application. This trusted relationship is built through the use of the exchange of trusted and verifiable credentials, known as certificates. Describe, with the aid of the diagram, and showing all the parties involved, how a browser sets up a trusted channel of communication with a server. (4 marks)



Question 3:

In software development, besides the business requirements of a system, an architect must satisfy the service-level or quality of service (QoS) requirements, also known as non-functional requirements. As an architect, it is your job to work with the stakeholders of the system during the inception and elaboration phases to define a quality of service measurement for each of the service-level requirements. The architecture you create must address the following service-level requirements: performance, scalability, reliability, availability, extensibility, maintainability, manageability, and security. You will have to make trade-offs between these requirements.

- a) What two factors affect the performance of a system?
-Response Time
-Throughput (2 marks)
- b) The most common practice to improve the system availability is through two types of replication, in which redundant hardware and software components are introduced and deployed. Name the two types of replication
-Active replication
-Passive replication (2 marks)
- c) Name two factors that affect the availability of a system
-System Down Time
-Long response Time (2 mark)
- d) List three practices used to ensure extensibility in a system.
-Clearly define the scope in the service-level agreement
-Anticipate expected changes
-Design a high-quality object model (3 marks)
- e) What is meant by vertical and horizontal scalability?
-Vertical scalability Adding more processing power to an existing server system,
-Horizontal scalability Adding additional runtime server instances to host the software system (1 mark)

Question 4:

- a) Transactions in software are encapsulated in the acronym ACID, which defines the four core requirements of a transaction. Answer the following questions.
(4 marks)
- i. What does Atomicity specifies ?-Either all steps of a transaction succeed or none succeed
- ii. What does Consistency refers to?-A transaction either commits in a valid database state or is rolled back to its original valid state
- iii. What does Isolation defines?-Transaction changes are not visible to other transactions until the trans-action commits.
- iv. What does Durability ensure?-Committed data is permanent and survives any system crashes.
-

- b) List the four the settings used to control isolation behavior for a given transaction.
- Read Uncommitted
 - Read Committed
 - Repeatable Read
 - Serializable
- c) In Java enterprise, using the **@Transactional** annotation, you can set some transactional behaviour and attributes. Propagation defines the transactional behaviour for the specified method. What transactional attribute is defined below

Execute the code within the “transactionalized” method non-transactionally and suspend the current transaction.

NOT SUPPORTED

Question 5:

- a) There are two type of configuration in J2ME mobile applications. Name two types of configurations and for each configuration list the requirements need on the device to run the configurations

CLDC-16-bit or 32-bit CPU with a clock speed of 16 MHz or higher

CDC- 32-bit CPU with about 2 MB of RAM, and 2.5 MB of ROM available for the Java application environment.

(2 marks)

- b) Android applications are made up of the following building blocks, Activities, Services , Content Providers and Intents. For each of the building blocks explain what they are and what they are used for.

-Activity - A screen in the Android application

-Services - Background activities without UI

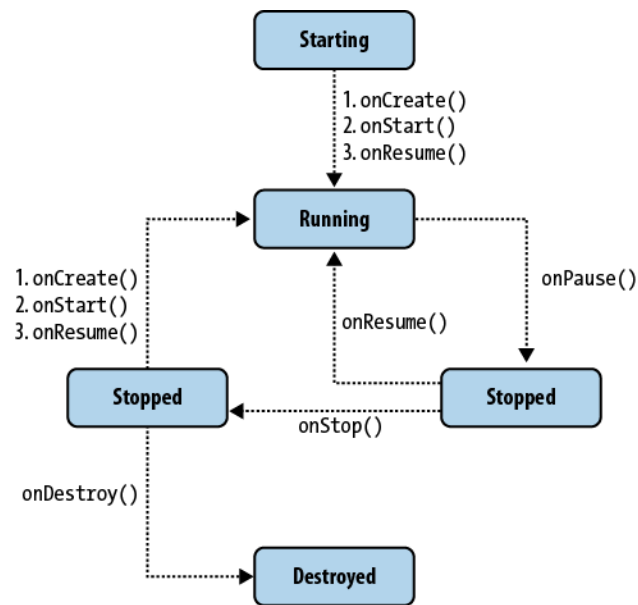
-Content Provider - provides data to applications, Android contains a SQLite DB which can serve as data provider

-Broadcast Receiver - receives system messages, can be used to react to changed conditions in the system

(4 marks)

- c) The diagram below shows the life cycle of an android application

(4 marks)



- i. In what state is an Activity when it is not visible, but still in memory? -**Starting**
- ii. In what state is an Activity when it doesn't exist in memory? -**stopped**
- iii. In what state is an Activity when it is not in focus (i.e., not interacting with the user) but still visible on the screen. -**stopped**
- iv. In what state is an Activity when it is currently on the screen and interacting with the user? -**Running**

--END OF SECITION C--

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