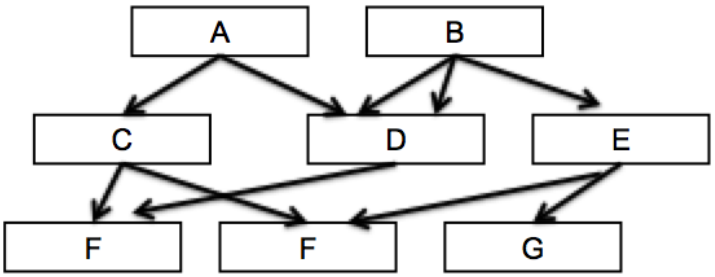
1 DESIGN

1.1 Which part to build/test first?



In the above diagram, boxes represent modules and arrows represent depends-on relationship.

a) What is bottom-up integration/construction? Explain using the above diagram. (3 points)
b) What is top-down integration/construction? Explain using the above diagram. (3 points)
c) What is a HUGE problem with bottom-up integration/construction? (4 points)

1.2 Drivers and Stubs (10 points)

a) What are drivers and where are they used? (3 points)
b) What are stubs and where are they used? (5 points)
c) What is Mockito? (2 points)
d) Bonus Question: Given module A depends on module B. List pseudocode to indicate how Mockito would be used to develop and test module A. (3 points)

1.3 Compile/Run/Debug Cycle (10 points)

a) Why is length of compile/run/debug cycle time very important during debugging (6 points)
b) Describe one way to reduce compile/run/debug cycle time during debugging? (4 points)

1.4 Class Diagram (7 points)

Draw a class diagram incorporating the following information.

1. There are two types of users: customer and administrator.
2. A customer has zero or more shopping carts.
3. A customer has zero or more orders.
4. Each order has a shipping-info.
5. Each order also has an order-detail object that has one or more items.
6. A customer has one or more credit cards.
7. There are four types of credit cards: Discover, MasterCard, American express, and Visa.
8. A user has userid and password attributes.

1.5 Sequence Diagram (8 points)

Draw Sequence diagram for method register being invoked on an RegisterOffice object (register is a method in class RegisterOffice). Aside from object **register** of type RegisterOffice, there is an AccountsReceivable object **ar** and a Course object **drama**.

```
void register(int studentId, AccountsReceivable ar, Course drama) {
   boolean pastDueBalance =  ar.getPastDueBalance(studentId);
   if (!pastDueBalance) {
      drama.addStudent(studentId);
      double classCost = drama.getCostOfClass();
      ar.chargeForClass(studentId, classCost);
   }
}
```

1.6 (10) Dependency Injection

```
public class TestClass {
	public static void main(String[] args) {
		GameLogic  g = new GameLogic();
		g.playGame();
	}
}

class VolleyComm {
	void sendToServer() { }
}

class GameLogic {
	VolleyComm c;

	GameLogic() {
		c = new VolleyComm();
	}

	void playGame() {
		c.sendToServer();
	}
}
```

In the above code, GameLogic depends on VolleyComm. Use DEPENDENCY INJECTION pattern to remove this dependency. Rewrite all code as needed. Make sure to inject dependency from TestClass.

1.7 (20 points) Visitor Pattern

a) (5 points) Draw class diagram for the Visitor pattern.

b) (5 points) Take ANY concrete example that uses the Visitor pattern. Name some classes in this concrete example that map to the pattern classes (as shown in the question above). Name at least one concrete class for each pattern class.

c) (10 points) Clearly explain the problem that this pattern attempts to solve and the benefits of using this approach over other approaches.

2 TESTING

2.1 Testing techniques (10)

a) Assume that a function takes age as an input and calculates tax for persons of working age (assume 18 to 65). Write down boundary value test cases for the function. (5 points)

```
if (c >= 20)) {
  doSomething():
   if (c == 20) { doSomethingElse(); }
}
Assume input variable is c.
```

b) Write test cases that will achieve 100% decision coverage for the above code.(5 points)

2.2 Automated testing (15)

You are to write an ORACLE for findFriendlyNodes method which takes in two parameters: a graph g and an integer v. It returns a List of all nodes of graph g that are connected to more than v neighbors. YOU CAN ASSUME that it always returns the correct **number** of friendly neighbors (not necessarily the correct ones). i.e. the size of the list returned is correct, but the entries in the list may be wrong.

findFriendlyNodes' signature is **List findFriendlyNodes (Graph g, int v)**

a) Write signature for this oracle. (4)
b) Write down the logic for this oracle? (6)
c) Explain why it is important to do regression testing. (5 points)

2.3 Discuss a) how to automate each step and b) how easy/hard it is to automate each of these steps. Make sure to give an example.

1. Generate test cases (i.e. come up with test inputs and outputs)
2. Create a driver to run tests
3. Compare actual outputs with expected outputs

2.4 (10 points) Importance of Automation

Why is it important to automate testing as much as possible?

2.5 (10 points) Black Box Test Case generation

Describe three black box techniques to generate test cases (i.e. come up with test cases)?

2.6 (10 points) Describe two code coverage techniques.

3 Ethics 20

3.1 Recently you were hired by a small, private hospital interested in upgrading their system for patient records and accounting. The hospital had already solicited proposals for upgrading their system, and has hired you to evaluate the proposals they'd received. After carefully examining the proposals you concluded that the hospital should buy the A-star system. You included a detailed explanation for why A-star bid was the best. You did not reveal to the hospital that you are a silent partner (a co-owner) in A-star Systems. We will assume that you evaluated the bids in good faith, and sincerely believed that A-Star had given the best bid.

a) What is a way to check if the above decision needed ethical treatment? (5)
b) Which of IEEE code of ethics principles does the above decision violate? (5)

c) Describe five approaches that can be used to find an ethical way to deal with the above decision? Make sure to give examples of each approach (10)

3.2 Your company is developing a free email service that will include targeted advertising based on the content of the email messages (similar to Google's Gmail). You are part of a team designing the system.

Does it pass the smell test?

what are the ethical issues?

Explain using any two of the five ethical approaches how you would make an ethical decision in this case.

3.3 (True situation!)Three ISU students were working on a project on software security when they discovered that they could hack into Blackboard! Discuss their ethical responsibilities. What actions should they take?

4 PROCESSMODELS

4.1 Describe the SCRUM process model. Also, describe some shortcomings of the SCRUM process model (10)

4.2 List and describe three process models of your choice and when they are applicable.

4.3 How would one **decide which process model to use** for a particular project?