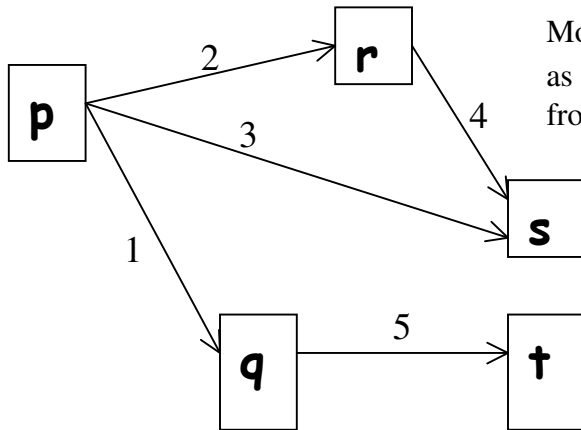


**1. Coupling Example (20 pts)**

Given a set of modules that print or store student status reports, with data-flow connections as shown in the diagram and table below (arrow direction is 'In' flow, and 'Out' flow is counter-arrow), determine the coupling type between modules (filling in the COUPLING TYPE table)

MODULE CALL/RETURN DATA		
number	In	Out
1	Student (complex object)	StudentValid flag
2	output function selector code	-
3	student id number	-
4	-	StudentReport (complex object)
5	student id number	student credit load



The file "F.TMP" is used by modules **p**, **s**, and **t**.  
 Modules **p** and **t** both write Student data to the file as well as read from it, while module **s** only reads from the file.

COUPLING TYPE (data, stamp, control, common, content)					
	<b>p</b>	<b>q</b>	<b>r</b>	<b>s</b>	<b>t</b>
<b>p</b>		(a)	(b)	(c)	(d)
<b>q</b>			(e)	(f)	(g)
<b>r</b>				(h)	(i)
<b>s</b>					(j)
<b>t</b>					

**2. True/False (10 pts):**

		T/F
a)	Java interfaces are useful for providing partial implementations of methods	
b)	White-box $C_2$ path test coverage ensures no bugs remain in a program	
c)	The key to meeting performance goals is early code optimization on a generic platform	
d)	Distributed application performance is independent of network effects	
e)	SCM systems resolve merge conflicts according to the Application Specification priorities	
f)	Informational cohesion is too weak for use with ADT implementation modules	
g)	A System/Application Acceptance Test Plan should be independent of the individual performance of each implementation module	
h)	According to the Stable Abstraction Principle, stable packages should be concrete	
i)	High Reliability implies high availability	
j)	Pipe and Filter architecture provides good support for concurrent execution	

**3. Equivalence Classes (5 pts)**

You are given a method signature and need to generate test cases for it; the method signature is:  
`public float squareRoot(int x) throws IllegalArgumentException;`

List the input equivalence classes for testing this function:

List boundary values for testing by showing an example input->expected response:

**4. Performance Analysis (10 pts)**

An application operates by receiving requests, creating a 5-MB size temp file for each request to hold interim results, then sending back the results and deleting the temp file. The processing time averages 12 seconds per request. Supposing you want to handle a throughput of 750 requests/sec, how much disk space should you expect the temp files to take, on average? (Your answer should be a simple calculation resulting in a size.)

**5. Robustness Analysis (5 pts)**

Given this sentence in a use case:

"The User adds his/her ID to the ClassListEntity."

What, if any, changes would robustness analysis require? (Your answer should be a simple sentence.)

WORTH 8% of the class grade, so 80 points

ESTIMATED TIME: 3 hours

## 6. Lecture Review UML (20 pts)

“You may review a lecture for extra credit! Your review is graded 0 .. 3, just as a regular paper review and with the same criteria, but the points awarded are 1/2 the points of a required review. So you can get 0, 5, 8, or 10 points for writing up a lecture. Each student can only review each lecture once; each lecture can be reviewed by any number of students. (Would diagramming that make a good UML question for the Final Exam?)”

**Yes, it would ☺** Draw a pair of UML diagrams capturing this description and showing implementation classes and relationships. In the approach taken below, the TA is the central “Factory” ... the TA learns of Reviewable things (lecture notes, perhaps) from the external “Instructor” actor, and tells the Students about them; if/when a Student decides to submit a Review, they ask the TA for a blank Review for that Reviewable, fill out the Review, submit it to the TA for scoring, and keep track of the scores they have received. Your response should be

(A) [10 pts] a UML static structure diagram including the classes shown below plus other classes you decide you need (my guess is you’ll have between X and Y total classes).

(B) Two UML sequence diagrams covering the scenarios of:

- (1) [5 pts] a normal review sequence for one review opportunity being accepted immediately by one Student and submitted for scoring, and
- (2) [5 pts] an asynchronous attempt by a Student to submit a Review for which they have already submitted a Review.

You are given the following class definitions to get started with:

```
interface Reviewable {
    void addReview(Student s) throws IllegalArgumentException;
    String getSubject();
}

interface Review {
    Reviewable getSubject();
    Student getAuthor();
    void setGrade0();
    void setGrade1();
    void setGrade2();
    void setGrade3();
    int getPoints();
}

interface Student{
    void doReview(Reviewable r); // creates Review and submits to TA for score
    int getScore(Reviewable r); // score on single Reviewable
    int getTotalScore(); // sum of all scores
}

interface TA{
    void newReviewableExists(Reviewable r);
    int receiveReview(Review r, Student s); // returns score
    Review getBlankReview(Reviewable r); // get form Review factory
}
```

### **7. Parallelism (10 pts)**

Suppose we have a program that runs on a single-processor machine in 10 seconds. The program has some parts which can be efficiently split into parallel processes across the network, but there is a part at the beginning and at the end which happens on just one processor (splitting data up for the parallel work, and combining the results.) On the single-processor machine, these two parts take 1 and 3 seconds, respectively.

You've been given a boatload of money to make this overall program run faster – you can add a lot of very fast parallel computers, and even use the new InfiniteSpeed/ZeroLatency network ☺ The single-CPU part of the program, though, has to stay on the existing computer (for security reasons). What's the shortest period of time you can hope to make this program take? Your answer should be a very short calculation invoking a well-known Law of operational research.

### **Free Questions! (0 pts)**

(0 pt) How do you get a development team to optimize for a particular characteristic?

(0 pt) What question took you the longest to answer, and how long was it?

(0 pt) How long did the entire test take you?