Part I: Short Answer

In a phrase or short sentence, write out the best answer for each question.

1.   (2 points) Define software engineering.

2.   (2 points) What phase or activity of the software lifecycle is the most costly?

3.   (5 points) What are the five steps of performing a cognitive walkthrough? (Hint: these are similar to the steps of a specification review).

4.   (2 points) In a data flow diagram, what do the circles and arrows represent, respectively?

5.   (2 points) Define information hiding.

6.   (2 points) True or False. High cohesion is generally desirably.

7.   (2 points) True or False. Loose coupling is generally desirable.

8.   (2 points) Define data coupling.

9.   (2 points) How is a sub-system different from a module (or set of modules)?

10. (2 points) Define polymorphism in object-oriented theory.

11. (4 points) What is the central argument of Brooks' book?

12. (4 points) What is the central conclusion of Brooks' book?

13. (2 points) Define "gutless estimating," one of Brooks' myths.

14. (2 points) Describe what Brooks means by the Man-Month Myth.

Part II: Essay/Long Answer

Read and follow the directions for each question CAREFULLY.

1.   A REBUS requirements document sometimes consists of a process program such as the one below (similar to the one discussed in class). The author writes such a process program to specify in detail how the requirements would be designed. Spend a few minutes examining this process program and answer the questions that follow.

```
procedure MultiUserModel is
begin
loop while not done
     case CurrentApproach is
       when TopDown =>
             if NeedRoot then
                   Post(CreateRoot);
             elseif NeedChildren then
                   SelectNodeToElaborate(CurrentNode);
                   if LockedBySomeoneElse(CurrentNode) then
                         raise LockViolation;
                   elseif NotLocked(CurrentNode) then
                         Lock(CurrentNode);
                   endif;
                   if Complete(CurrentNode) then
                         UnLock(CurrentNode);
                         Repost(CurrentNode);
                   else
                         CreateChildren(CurrentNode,CurrentNodeSet);

                         loop for Node in ChildNodeSet
                               Post(Node);
                         endloop;
                   endif;
             else
                   SelectNodeToEdit(CurrentNode);
                   if Complete(CurrentNode) then
                         UnlockNode(CurrentNode);
                         PostOrSubmit(CurrentNode);
                   else
                         -- test lock and set posting as above
                         EditNode(CurrentNode);
                   endif;
             endif;
       ...
       when BottomUp =>
       ...
       when Arbitrary =>
       ...
     endcase;
endloop;
end MultipleUserModel.
```

1.a.   (1 point) How many developers can this process accommodate?

b.   (3 points) What three design strategies are identified for this development project?

c.   (2 points) What mechanisms are implied for coordinating the activity of development team members?

d.   (10 points) Write a few lines of pseudocode to show locking and testing of posted nodes that are ready-to-test and what would happen if the test fails or succeeds.

2.   Examine the table below which illustrates the classes, attributes, and operations for four related classes. Follow the directions which follow.

Class	Attributes	Operations
ball	radius, weight	catch, throw
football	inflation-factor, #stitches	pass, kick, hand -off
baseball	#stitches, liveness	hit, pitch tag
basketball	inflation-factor	shoot, dribble, pass

a.   (10 points) Using OMT notation, draw an object model which illustrates the four classes and the relationships that football, baseball, and basketball are all subclasses of ball.

b.   (4 points) Redraw just the class for ball illustrating data types for the attributes and parameter types for the operations. To do this, assume that radius and weight are real numbers; that the operation throw requires a direction and a destination; and that the operation catch requires a direction.

3.   (15 points) Using OMT notation, write out an event trace for the following sequence of actions between three objects: CALLER, PHONE LINE, CALLEE.

       CALLER LIFTS RECEIVER
       DIAL TONE BEGINS
       CALLER DIALS 4
       CALLER DIALS 1
       CALLER DIALS 1
       CALLED PHONE BEGINS RINGING
       RINGING TONE APPEARS IN CALLING PHONE
       CALLEE LIFTS RECEIVER
       CALLED PHONE STOPS RINGING
       RINGING TONE DISAPPEARS IN CALLING PHONE
       PHONES ARE CONNECTED
       CALLING PARTY HANGS UP
       PHONES ARE DISCONNECTED
       CALLED PARTY HANGS UP

4.   (10 points) Read the following description of a system and draw a (likely) architectural design. The design should conform to the style of an interrupt-driven model.

An automated factory for filling soft drink bottles has three simple controls for the operator: START, STOP, and CALL-FOREMAN. The START control causes a START-UP process to run. The STOP control causes a SHUT-DOWN process to run. The CALL-FOREMAN control ISSUES A PAGE and SENDS EMAIL.

5.   (10 points) Read the following description of a system and draw a (likely) architectural design. The design should conform to the style of a client-server model.

The telephone company has a system that allows users to set up new service orders for customers. The system allows up to 5 users to be logged in, 1 of the 5 is a SUPERVISOR with special privileges. The system allows the users to check an options database to see what services are allowed for a given street address (available options vary depending on the equipment in a neighborhood). The system allows the users to check a customers CREDIT DATABASE to see if the customer should be allowed to have a new account. Any new account information is stored in an ACCOUNTS DATABASE.