You must pledge the exam on the scantron. I assume that your work is pledged, even if you do not do so. Please write your email on the scantron page.

This exam is closed note, closed book. You are not to speak with anyone except the Instructor or a teaching assistant for any reason except an emergency during the exam.

Use the scantron to answer the questions. You must fill in your name, the test (Exam 1) the date and the course CS201. You must fill in your ID number or you will receive NO credit on this exam. The test number is 0001.

You must fill in this page and return the entire exam. Do not keep this exam paper.

If the question starts with [T/F], then fill in circle A for True and fill in circle B for False. If the question starts with [MC] or [Multiple Choice], then fill in the appropriate circle.

The exam is a total of 100 points. Good Luck!
Answer the following T/F questions.

1. [ F ] Problem specification refers to a statement about the objects needed for a program.
2. [F] Testing starts after implementation is complete.
3. [T ] Program design is as important as good implementation.
4. [T ] Object-oriented design organizes a problem by the objects in it and their functionality.
5. [ F] Testing is the last phase of the software life cycle.
6. [T] Code reuse is facilitated by an object-oriented organization.
Answer the next questions based on the following problem specification: \textit{Take N names and find the closest match to a key name. Print that name.}

7. [F] We don’t know how many names there are.
8. [T] “Closest” is not well defined.
9. [T] We don’t know what to do if \( N = 0 \).
10. [F] We don’t know what to output from the problem.
11. [T] We don’t know what a “name” really is.
Which of the following are necessary parts of the software life cycle?

12. [T] Coding
13. [F] Software reuse
14. [F] eXtreme programming
15. [T] Maintenance
16. [F] Verification
17. [T] Program design
18.  [Multiple-choice] From the following, select the best definition of “unit testing.”
(a) Testing random pieces of a program to flush out errors.
(b) Testing how two or more units work together.
(c) Testing every possible flow path of a unit before moving on to implement another unit.
(d) Testing a single unit on garbage data to see how it reacts.
(e) Testing that every line of code in a unit is logically correct.

Answer the following T/F questions:

19.  [F] Problem specification entails laying out how the program will perform its task.
20.  [T] Clear box testing occurs when testing the units of a program or their interactions together, when the testing process is done with knowledge of the actual internals of each unit.
Consider the following problem specification: 
*Read numbers from a user and keep track of the largest and smallest values, and print them.*
Which of the following are ambiguities about the problem specification:

21. [T] We don’t know what kind of numbers they are.
22. [T] How will we know to stop reading
23. [T] Could zero numbers be read? What then?
24. [T] What if only one number is read?
25. [T] Does “print them” refer to the whole collection or just the largest and smallest.
Answer the following True/False questions:

26.  [F] The “specification” form of inheritance makes the subclass more specific: it limits the use of some behaviors defined in the superclass.
27.  [T] The “combination” form of inheritance is not possible in Java.
28.  [T] An object has state, behavior and identity.
29.  [F] When finding classes in requirements and specifications, consider the verbs used to describe the project.
30.  [T] An object is a part of a UML class diagram.
31.  [T] Inheritance is part of a UML class diagram.
32.  [F] Invocation is part of a UML class diagram.
33.  [T] Multiplicity is part of a UML class diagram.
Read the following specification:

*A board is a 3x3 grid. In eight spaces of the grid are numbered tiles. The user can slide tiles up, down, left, or right into the one empty space. A counter keeps track of how many moves the user makes. The game ends when all eight tiles are in numeric order, top to bottom, left to right, and the empty space is in the lower right corner.*

For the next questions, you must match the given noun with its best use in the program:
   a) A class
   b) Part of the state of a class
   c) A behavior of a class
   d) Not in the program.

34.  [a] Board
35.  [b] Grid <- ambiguous
36.  [b] Counter <- wrong answer in scoring
For the following questions, match each kind of inheritance to its definition:

(a) specification
(b) specialization
(c) extension
(d) limitation
(e) combination

37. [d] The subclass limits the use of behaviors inherited from the superclass.
38. [b] (wrong answer on key) The subclass inherits some behavior implementations from its superclass, and implements some others that the superclass merely defines.
39. [a] The superclass defines behaviors that the subclass implements.
40. [e] The subclass inherits features from multiple superclasses.
41. [c] The subclass adds new behaviors to the superclass.
Consider the following UML diagram:

```
Tree  ---->  Bird  ---->  Seed
          |      |        |
+--------+      +--------+
|   ^   |      |      |
+---+   |      |      |
   |     |      |      |
Cardinal Flycatcher
```

Answer the following questions:

42.  F] Cardinals and Flycatchers are superclasses of the class Bird.
43.  [T] Birds use Trees and Seeds
44.  [T] Cardinals and Flycatchers inherit from Bird.
Consider the following code Fragment

class A extends B {
    private int currBal = 0;
    protected String myName = "Default";
    ...
    public void methoda(A varA) {
        varA.currBal = 33;
    }
}

A instA = new A();
A secA = new A();

45. [T] The variable currBal that belongs to instA is directly accessible to any instance of class A, such as secA.
46. [F] Any instance of class B may access directly the variable myName.
47. [T] Subclasses of A must access currBal through A’s instance methods.
48. [F] The variables instA and secA have shallow equality.
49. [F] An instance variable for a class A that is private can be directly accessed by objects of class A or subclasses of A.
50. [T] An instance variable of class A that may be directly accessed by objects of class A or A’s subclasses, but not other classes, should be declared protected.
Answer the following questions:

51. [T] A variable that is declared final may not be changed after its initialization.

52. [T] A public class method may be called by methods belonging to any class.

53. [T] A private instance method may be called by other methods belonging to instances of that class.

54. [F] To declare a class method, the keyword class is placed in the method declaration.

55. [F] A static method is one that may not be redefined by a subclass.

56. [F] The following code fragment creates an instance of the class C and makes instC a reference to it:

C instC;