

[May use one 8.5 × 11 inch sheet of paper for notes.] Show all of your work clearly in the space provided or on the additional page at the end of the exam. If the additional page is used, clearly identify to which exam question it is related. Be sure to **read each problem carefully**. Note that the exam is double sided.

1. (15 points) True/False (T or F)

- \_\_\_\_\_ Math.PI is declared as a `private` attribute.
- \_\_\_\_\_ If `import java.util.Scanner` is not present before the class declaration, all occurrences of `Scanner` must be replaced with `java.util.Scanner`.
- \_\_\_\_\_ If a method is overloaded, it means that there are two methods with exactly the same name that return different types (e.g., one returns `String` while the other returns `double`).
- \_\_\_\_\_ Local variables declared in a constructor are only accessible within that constructor.
- \_\_\_\_\_ The following will generate a random integer value no less than -10 and no greater than 10:  

```
(int)(Math.random()*20.1) - 10;
```
- \_\_\_\_\_ `Math.cos(30)` is a call to a class method.
- \_\_\_\_\_ The following code will result in `answer` being `true`:

```
String word;  
boolean answer = word.isEmpty();
```

2. (10 points) Give an example of a wrapper class. What is the purpose of a wrapper class?



3. (5 points) Define the term **fully qualified name**.

4. (5 points) Describe the role of the garbage collector.

5. (5 points) Explain why object variables are typically declared as `private`.

6. (20 points) Write the complete implementation of the class shown in the UML diagram below.

Rocket	
-	fuelKg: double
-	name: String
+	Rocket(name: String)
+	setFuelKg(fuelKg: double): void
+	getName(): String
+	getFuelKg(): double



6. continued

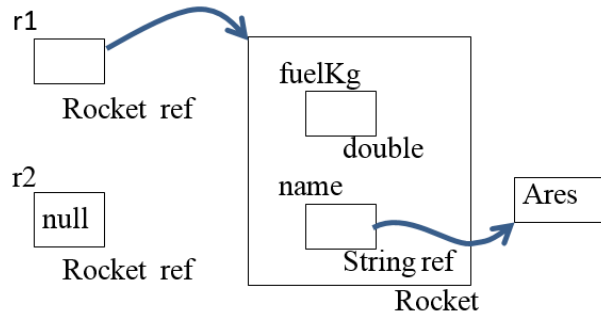
7. (15 points) Complete the following diagram that illustrates the state of memory at four points in the program on the right. The solution to step (b) is provided as an example.

(a)

```

Rocket r1 = null;
Rocket r2 = null;
// (a)
r1 = new Rocket("Ares");
// (b)
r1.setFuelKg(500);
r2 = r1;
// (c)
r1 = new Rocket("Saturn.V");
// (d)
    
```

(b)



(c)

(d)

8. (25 points) Complete the program below so that the following is true:

- If the user does not enter anything or enters a `String` with fewer than four characters, the program displays an error message and repeatedly displays the input dialog box.
- If the user selects cancel (then `null` is returned from the call to `showInputDialog()`), then the program terminates immediately.
- If the user enters a `String` with more than four characters, your program should display the square root of the total number of vowels (a, e, i, o, or u) entered by the user.
- The output must be displayed to the console.
- The number displayed should have three places after the decimal.
- Your program must not crash.

For example, if the user enters **"His cow is ready to calf too."**, your program should display: **"The square root of the number of vowels entered is 3.000"**.

```
public static void main(String [] args) {  
    String input = null;
```

```
    input = JOptionPane.showInputDialog("Enter at least four characters");
```



Additional space — indentify which problem your work is associated with.



Additional space — identify which problem your work is associated with.