Part 1: Multiple Choice (102 points - 3 points per question)

(B) 1. Which statement is true?
   (A) Source code is compiled into object code called Bite-code. (B) $0$ is a valid Java identifier.
   (C) Java supports multiple inheritance. (D) none of the above
   (A) 6 (B) 7 (C) 8 (D) None of the above

(D) 2. Which of the following Java identifiers is not valid?
   (A) sourceCode (B) _java (C) _java_ (D) $java$
   (D) None of the above

(D) 3. Standard code libraries in Java are called: (A) bundles (B) classes (C) methods (D) packages
   (C) 4. How many "Hi!" is printed after running $i = 1000; while ((i /= 2) >= 1) { (A) 7 (B) 8 (C) 9 (D) None of the above
   (D) 5. An ArrayIndexOutOfBoundsException error is a (A) compiler error (B) syntax error (C) logic error (D) none of the above
   (A) 6. Which is a method that is used to return the value of a variable in a object?
      (A) accessor (B) constructor (C) mutator (D) none of the above
   (B) 7. Given int a[5] = {6, -8, 12, 2, 3}, i = 2. What is the value of a[a[i * i]] + a[i]?
      (A) 12 (B) 14 (C) 16 (D) None of the above
   (C) 8. Consider an integer, i and an int array, a. Which is the correct way to use the for each in Java?
      (A) for (int i : a[]) a = 0; (B) for each (long i : a[ ]) i = 0; (C) for (int i : a) i = 0; (D) none of the above
   (B) 9. To declare a constant in Java, which modifier should be used?
      (A) abstract (B) final (C) constant (D) none of the above
   (C) 10. Which class cannot be instantiated? (A) final. (B) concrete. (C) abstract. (D) polymorphic.
   (B) 11. Which is the benefit of polymorphism? (A) adaptability (B) extensibility (C) feasibility (D) none of the above
   (B) 12. Which operating system is Android based on? (A) Windows (B) Linux (C) MacOS (D) none of the above
   (C) 13. Which is the code name of Android 4.4? (A) Gingerbread (B) Honeycomb (C) KitKat (D) Lollipop
   (A) 14. Which is the file format used to distribute and install Android application?
      (A) APK (B) AVD (C) ADT (D) none of the above
   (D) 15. Which class is used to notify the user of events that happen?
      (A) BroadcastReceiver (B) Dialog (C) Handler (D) NotificationManager
   (B) 16. Which is the resources types for images? (A) R.anim (B) R.drawable (C) R.menu (D) none of the above
   (A) 17. Which command is used to access the Android shell?
      (A) adb shell (B) keytool shell (C) boot shell (D) none of the above
   (C) 18. Which class hosts a ListView object that can be bound to different data sources?
      (A) ListActivity (B) FrameList (C) PreferenceView (D) none of the above
   (A) 19. Which is the library that supports database connectivity is called:
      (A) JDBC (B) MDDB (C) ODBC (D) none of the above
   (D) 20. Which input type is used to indicate a decimal?
      (A) decimal (B) decimalNumber (C) numberDecimal (D) none of the above
   (D) 21. Which class is used to displays a video file? (A) VideoView (B) VideoPlayer (C) MediaView (D) none of the above
   (B) 22. Which can lets you access the device's sensors?
      (A) SensorProvider (B) SensorManager (C) SensorService (D) SensorAdaptor
   (A) 23. Which thread is used to manage the device's threads?
      (A) adb shell (B) keytool shell (C) boot shell (D) none of the above
   (C) 24. In which fashion do threads execute? (A) complex (B) serial (C) parallel (D) none of the above
   (A) 25. Which allows you to send and process Message and Runnable objects associated with a thread's MessageQueue?
      (A) Handler (B) UIThread (C) QueueThread (D) none of the above
   (D) 26. Which is not a way to create thread in Java?
      (A) extending Thread class (B) implementing Runnable interface
      (C) using Executor framework (D) using Handler class
Part 2: Questions and Answers (63 points)

1. (a) (3 points) What is an instance method?
   (b) (3 points) What is an interface?
   (c) (3 points) What is an abstract class?
   (d) (3 points) Explain runOnUiThread of Activity class.

   (a) A instance method is a method which must be invoked via an instance of a class.
   (b) An interface is an abstract type that is used to specify an interface that classes must implement.
   (c) An abstract class is a class at least one of its methods cannot be implemented.
   (d) runOnUiThread runs the specified action on the UI thread. If the current thread is the UI thread, then the action is executed immediately. If the current thread is not the UI thread, the action is posted to the event queue of the UI thread.

2. (10 points) Illustrate Android architecture. List the four layers and at least two components in each layer.

3. (10 points) Illustrate state transitions of an activity.

![Activity State Transitions Diagram]

4. (10 points) Write a program that read n and randomly generate n pairs of different numbers from 1 to \( \frac{n^2}{2} \).

```java
import java.util.Random;
import java.util.Scanner;
```
public class RandomNumber {
    public static void main(String[] args) {
        Scanner input = new Scanner(System.in);
        System.out.print("Enter n: ");
        int n = input.nextInt(), size = n * n;
        int[] a = new int[n];
        Random r = new Random();
        for (int i = 0; i < n; i++) {
            a[i] = r.nextInt(size) + 1;
            for (int j = 0; j < i; j++)
                if (a[i] == a[j]) {
                    i--;
                    break;
                }
        }
        for (int i = 0; i < size; i++) a[i] /= 2 + 1;
    }
}

5. (21 points) Consider the following class for a point: class Point { private double x, y; }
Create a Triangle class based on the Point class: class Triangle { private Point a, b, c; }

(a) (6 points) Complete the Point class including the constructors, accessors, and mutators.
(b) (3 points) Create a function for the point that passes two points and returns the distance between them.
(c) (6 points) Based on the Point class to complete the Triangle class including the constructors, accessors, and mutators.
(d) (6 points) Write a area method for the Triangle class that returns the triangle area. If the triangle cannot be formed, returns 0.

Hint: The area of the triangle is $\sqrt{s(s-a)(s-b)(s-c)}$ where a, b, and c are three sides of the triangle and $s = \frac{a+b+c}{2}$.

(a) class Point {
    private double x, y;
    public Point(double _x, double _y) { setPoint(_x, _y); }
    public void setPoint(double _x, double _y) { x = _x; y = _y; }
    public double getX() { return x; }
    public double getY() { return y; }
    public double distance(Point a, Point b) {
        return Math.sqrt((a.getX() - b.getX()) * (a.getX() - b.getX()) +
                         (a.getY() - b.getY()) * (a.getY() - b.getY()));
    }
}
(b) class Triangle {
    private Point a, b, c;
    public Triangle(Point _a, Point _b, Point _c) {
        setPoint(_a, _b, _c);
    }
    public void setPoint(Point _a, Point _b, Point _c) {
        a = _a; b = _b; c = _c;
    }
    Point getA() { return a; }
    Point getB() { return b; }
    Point getC() { return c; }
    public double area() {
        double ab = distance(a, b), bc = distance(b, c), ca = distance(c, a);
        if (ab + bc > ca && bc + ca > ab && ca + ab > ca) {
            double s = (ab + bc + ca) / 2;
            return Math.sqrt(s * (s - ab) * (s - bc) * (s - ca));
        } else return 0;
    }
}