Foundations of Programming

(a) Distinguish between the terms *abstract class* and *interface*. [3 marks]

(b) Explain in detail what happens when class GPS below is instantiated noting, in particular, any assignments that are made. [17 marks]

```java
class GPS {
    public int[][] a = new int[4][4];
    private int[] i = new int[1];
    private int[] j = new int[1];

    public GPS() {
        this.j[0] = this.gps(this.j, 4, new Pi(), new Fg());
    }

    private int gps(int[] i, final int N, Pass z, Feval v) {
        i[0] = 0;
        while (i[0]<N) {
            z.p(v.f());
            i[0]++;
        }
        return 0;
    }

    private abstract class Pass {
        public abstract void p(int n);
    }

    private class Pi extends Pass {
        public void p(int k) {
            GPS.this.i[0] = k;
        }
    }

    private class Pij extends Pass {
        public void p(int k) {
            GPS.this.a[GPS.this.i[0]][GPS.this.j[0]] = k;
        }
    }

    private abstract class Feval {
        public abstract int f();
    }

    private class Fij extends Feval {
        public int f() {
            return GPS.this.i[0]+GPS.this.j[0];
        }
    }

    private class Fg extends Feval {
        public int f() {
            return GPS.this.gps(GPS.this.i, 4,
                                 new Pij(), new Fij());
        }
    }
}
```