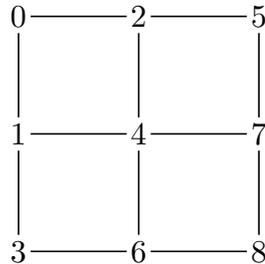


2001 Paper 11 Question 2

Foundations of Programming

A graph consists of nine numbered vertices and 12 edges thus:



By inspection, it is clear that to get from vertex 0 to vertex 8 there are just six routes in which progress is always from a lower-numbered vertex to one with a higher number.

A programmer wishes to write a Java program to count the routes and begins with the following code:

```
public class Routes
{ private static final int[] first = {1,3,4,6,6,7,8,8};
  private static final int[] second = {2,4,5,0,7,0,0,0};
  private static int[] state = {-1,-1,-1,-1,-1,-1,-1,-1,+1};

  public static void main(String[] args)
  { System.out.println("There are " + tryit(0) + " routes");
  }

  private static int tryit(int vertex)
```

Together the **first** and **second** arrays form a data structure representing the graph. Explain and critically comment on these arrays. [5 marks]

Ultimately, element *v* of the array **state** is intended to show the number of routes from vertex *v* to vertex 8. A value of **-1** indicates that the number is not yet known. The method `tryit(int vertex)` returns the value of `state[vertex]`, calculating and saving this value first if necessary. Supply an appropriate body for this method and explain its operation. [15 marks]