

2011 Paper 3 Question 1

Algorithms II

The pseudocode below is a first attempt at a recursive algorithm to enumerate all the paths from source to sink, in the context of a maximum flow problem.

```
0 def allPaths(graph, source, sink):
1     # Each path is a list of vertices from source to sink, eg [2, 4, 7]
2     # The result is a list of paths, eg [[2, 4, 7], [2, 7]], initially empty
3     result = []
4
5     if source == sink:
6         result.append([source])
7     else:
8         for v in graph.verticesAdjacentTo(source):
9             for path in allPaths(graph, v, sink):
10                # Reject paths that revisit the source, else infinite loops
11                if source not in path:
12                    result.append([source] + path)
13     return result
```

- (a) Point out all the bugs you can find, highlighting the failures with test cases. [5 marks]
- (b) Correct all the bugs you found, clearly explaining your fixes. Rewrite a corrected and clearly commented version of the pseudocode. [10 marks]
- (c) Provide a correctness proof for your new version. [5 marks]