

Unit 6: Algorithms and Graph Theory (part 2)

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SPECIFICATION REFERENCES

1.4 The planarity algorithm for planar graphs.

PRIOR KNOWLEDGE

GCSE (9-1) in Mathematics at Higher Tier

R13 Construct and interpret equations that describe direct and indirect proportion

KEYWORDS

Algorithm, flow chart, size, order, efficiency, loops, bubble sort, iteration, quick sort, pivot, mid-point, bin packing, first-fit, first-fit decreasing, optimal solutions, vertices, nodes, edges, arcs, graph, network, path, cycle, Hamiltonian cycle, Eulerian graph, semi-Eulerian graph, Eulerian cycle, subgraph, weighted graph, connected graph, simple graph, complete graph, degree, valency, digraph, tree, spanning tree, k notation, isomorphic, planar.

6a. Planarity algorithm (1.4)**Teaching Time**

5 hours

OBJECTIVES

By the end of the sub-unit, students should:

- be able to apply the planarity algorithm for planar graphs;
- be able to determine if a graph contains a Hamiltonian cycle.

TEACHING POINTS

Revisit the teaching on planar graphs from the previous section. Discuss some ‘real-world’ examples like uninsulated wires on circuit boards.

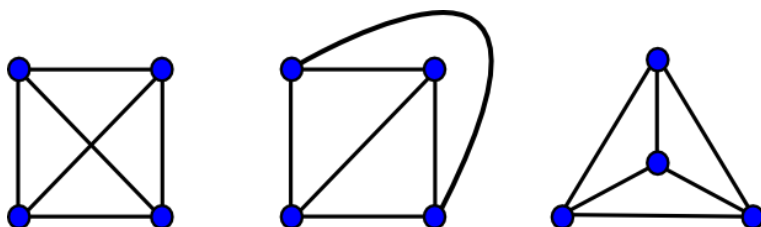
The planarity algorithm determines if a graph is planar or not, but only works on graphs that contain a Hamiltonian cycle.

Define Hamiltonian cycles, ensuring that students are aware that not all edges have to be included. If there are n nodes there will be $(n - 1)!$ Hamiltonian cycles.

The final graph drawn after completing the planarity algorithm will be the planar representation of the original graph.

OPPORTUNITIES FOR REASONING/PROBLEM SOLVING

Draw different versions of the same graph, e.g. for K_4 planar graph, left, a plane drawing, centre, and a straight line drawing, right.

**COMMON MISCONCEPTIONS/ EXAMINER REPORT QUOTES**

Most students understand what is meant by the word planar, but some do not use the planarity algorithm and simply draw graphs in planar form. Those who sought a Hamiltonian cycle and drew this as a polygon separating two sets of arcs were usually successful, although a few forgot to draw double arcs.

When answering one particular exam question, a surprisingly large number of students did not make any connection between the Hamiltonian cycle and the planar graph and tried to draw the graph without first drawing the cycle as a boundary between the two sets of arcs.

NOTES

Students will be expected to be familiar with the term ‘Hamiltonian cycle’.