



QUESTION WORKBOOK

Linear programming: formulation and graphical solution

Decision Mathematics 1 · Year FM

7 questions · 26 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

- A1** State the three things a formulated linear program must contain, and one thing candidates most often leave out. [2]

- A2** Write $3x + 2y \leq 20$ and $5x + 2y \geq 30$ as equations, introducing the appropriate extra variables. [3]

SECTION B · Standard

- B1** A workshop makes tables and chairs. Each table needs 4 hours of machining and 2 hours of finishing; each chair needs 1 hour of machining and 2 hours of finishing. At most 40 machining hours and 36 finishing hours are available in a week. The profit is £30 on a table and £16 on a chair. Formulate this as a linear program. [4]

- B2** Maximise $P = 4x + 5y$ subject to $x + y \leq 10$, $2x + 3y \leq 24$ and $x, y \geq 0$, using the vertex method. [4]

- B3** For the linear program of maximising $P = 4x + 5y$ subject to $x + y \leq 10$, $2x + 3y \leq 24$ and $x, y \geq 0$, describe the objective line method and say what it shows that testing the vertices does not. [3]

- B4** The linear program of maximising $P = 4x + 5y$ subject to $x + y \leq 10$, $2x + 3y \leq 24$ and $x, y \geq 0$ has its optimum at $(6, 4)$. Find the value of each slack variable there and say what it means. [3]

SECTION C · Stretch

- C1** Maximise $P = 5x + 4y$ subject to $2x + 3y \leq 12$, $4x + y \leq 10$ and $x, y \geq 0$. Find the optimum by the vertex method, then find the optimum when x and y must both be whole numbers, and explain why rounding the first answer does not give the second.

[7]