

# Linear Programming – Q6: Formulating as LP problem

[4 marks](15/6/21)

## Exam Boards

OCR : -

MEI: MWA

AQA: -

Edx: -

(i) Workers A-E are to be allocated tasks, so that each worker carries out one task, and each task is carried out by one worker. The table below shows the time taken to train each worker for each task. The aim is to minimise the time spent on training. Formulate this as a linear programming problem.

	1	2	3	4	5
A	4	3	7	2	6
B	2	5	5	4	5
C	3	6	2	6	7
D	4	3	5	7	3
E	3	5	7	4	4

(ii) If in fact worker A cannot carry out task 1, what modification would be necessary?

[4 marks]

## Solution

(i) With  $A_1, A_2, \dots, A_5$  being binary variables, where  $A_1 = 1$  means that worker A carries out task 1:

Minimise  $P = 4A_1 + 3A_2 + \dots + 4A_5$  [1 mark]

[ie minimise the total time spent on training]

subject to the following constraints:

$A_1 + A_2 + A_3 + A_4 + A_5 = 1$  [just one of  $A_1, A_2, A_3, A_4, A_5$  must be 1]

and similarly for B, C, D & E [1 mark]

$A_1 + B_1 + C_1 + D_1 + E_1 = 1$

and similarly for 2,3,4 & 5 [1 mark]

(ii) To allow for the fact that worker A cannot carry out task 1, increase the element of the table in row A and column 1 from 4 to a large number, such as 100. [1 mark]