

D2 Allocation Challenge

Challenge 1

The following table shows the times taken, in minutes, by four people *A*, *B*, *C* and *D* to carry out four tasks 1, 2, 3 and 4. Each person is to be assigned to a task.

	Task 1	Task 2	Task 3	Task 4
<i>A</i>	18	12	6	9
<i>B</i>	13	22	17	28
<i>C</i>	17	11	26	8
<i>D</i>	16	18	19	21

Use the Hungarian algorithm to obtain the allocation of people to tasks that requires the minimum total time. State this minimum time. *(6 marks)*



Challenge 2

The manager of a company places different adverts in four newspapers, *P*, *Q*, *R* and *S*. The cost of each advert varies from newspaper to newspaper. The costs, in £000's, are shown in the following table.

Newspaper	Cost (£000's)			
	Advert 1	Advert 2	Advert 3	Advert 4
<i>P</i>	37	40	43	31
<i>Q</i>	33	40	45	33
<i>R</i>	39	38	44	32
<i>S</i>	35	39	46	35

Use the Hungarian algorithm to decide how the manager should place each advert in a different newspaper to minimise the total cost to his company. State this minimum cost. (9 marks)



Final Challenge

The coach of a relay team has five athletes from which he is to choose four to run the four legs of a relay race. The time, in seconds, which the coach assumes each athlete will take to run each stage of the relay is shown in the following table.

Athlete	Relay stage			
	1	2	3	4
A	66	67	63	60
B	67	71	73	61
C	61	70	65	63
D	69	72	74	62
E	70	68	76	65

- (a) Use the Hungarian algorithm to decide how the coach should choose the four athletes, one for each stage, to minimise the total time for the team. State the minimum time. *(9 marks)*
- (b) The coach also wants to find the maximum time that the team would take to complete the relay race. Write down an amended matrix that would enable the coach to find the maximum time using the Hungarian algorithm. *(3 marks)*



