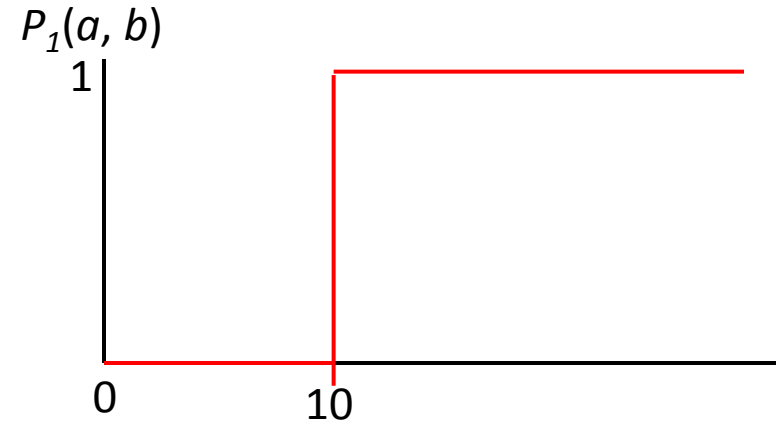
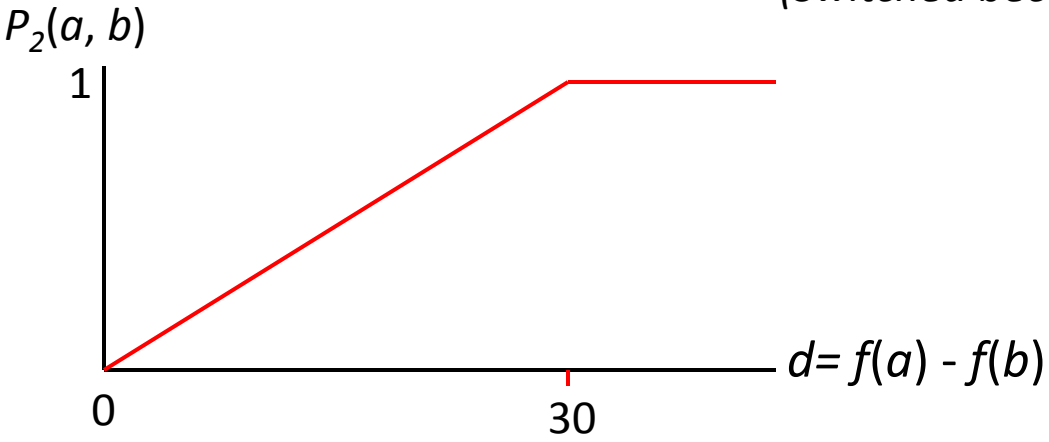
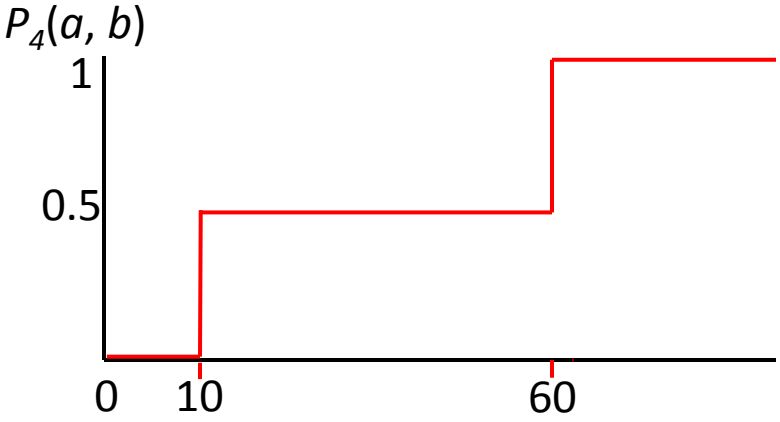
Exercise:
Using the 3 generalised preference criteria on the next slide, calculate the aggregated preference index for each pair of alternatives



Manpower (C1)



Power Consumption (C2)



Annual Maintenance Cost (C4)

	C_1	C_2	C_4
	min	max	min
A_1	80	90	54
A_2	65	58	97
A_3	83	60	72

(Criteria are all weighted the same)

Aggregated preference index

$P(A_1, A_2)$ =

$P(A_1, A_2)$ =

$P(A_2, A_1)$ =

$P(A_2, A_3)$ =

$P(A_3, A_1)$ =

$P(A_3, A_2)$ =

Answers

E.g.
65-80 = -15
Preference value for -15 is 0, according to $P_1(a, b)$

	C_1	C_2	C_4
	min	max	min
A_1	80	90	54
A_2	65	58	97
A_3	83	60	72

Criteria are all weighted the same

$P(A_1, A_2) = ((0 + 1 + 0.5) / 3) = 1.5/3 = 0.5$

$P(A_1, A_2) =$

$P(A_2, A_1) =$

$P(A_2, A_3) =$

$P(A_3, A_1) =$

$P(A_3, A_2) =$

Answers

	C_1	C_2	C_4
	min	max	min
A_1	80	90	54
A_2	65	58	97
A_3	83	60	72

Criteria are all weighted the same

$P(A_1, A_2) = ((0 + 1 + 0.5) / 3) = 1.5/3 = 0.5$

$P(A_1, A_3) = (0 + 1 + 0.5) / 3 = 1.5/3 = 0.5$

$P(A_2, A_1) = (1 + 0 + 0) / 3 = 1 / 3 = 0.333$

$P(A_2, A_3) = (1 + 0 + 0) / 3 = 1/3 = 0.333$

$P(A_3, A_1) = (0 + 0 + 0) / 3 = 0 = 0$

$P(A_3, A_2) = (0 + 0.0667 + 0.5) / 3 = 0.5667/3 = 0.189$

Next step:
Calculate the positive outranking flow, negative outranking flow, and net outranking flow for each alternative

$P(A_1, A_2) = 0.5$
$P(A_1, A_3) = 0.5$

$P(A_2, A_1) = 0.333$
$P(A_2, A_3) = 0.333$

$P(A_3, A_1) = 0$
$P(A_3, A_2) = 0.189$

From previous calculations

Positive outranking flow

$\phi^+(A_1) = 0.5 + 0.5 = 1$
$\phi^+(A_2) = 0.333 + 0.333 = 0.667$
$\phi^+(A_3) = 0 + 0.189 = 0.189$

Negative outranking flow

$\phi^-(A_1) = 0.333 + 0 = 0.333$
$\phi^-(A_2) = 0.5 + 0.189 = 0.689$
$\phi^-(A_3) = 0.5 + 0.333 = 0.833$

Positive outranking flow

$\phi^+(A_1) = 0.5 + 0.5 = 1$

$\phi^+(A_2) = 0.333 + 0.333 = 0.667$

$\phi^+(A_3) = 0 + 0.189 = 0.189$

Negative outranking flow

$\phi^-(A_1) = 0.333 + 0 = 0.333$

$\phi^-(A_2) = 0.5 + 0.189 = 0.689$

$\phi^-(A_3) = 0.5 + 0.333 = 0.833$

From last slide

"Promethee 1" method provides a partial ordering. In this simple case, there are no indifferent or incomparable pairs of alternatives.

A_1 outranks A_2

A_2 outranks A_3

This leads to the ordering A1, A2, A3

Positive outranking flow

$\phi^+(A_1) = 0.5 + 0.5 = 1$

$\phi^+(A_2) = 0.333 + 0.333 = 0.667$

$\phi^+(A_3) = 0 + 0.189 = 0.189$

Negative outranking flow

$\phi^-(A_1) = 0.333 + 0 = 0.333$

$\phi^-(A_2) = 0.5 + 0.189 = 0.689$

$\phi^-(A_3) = 0.5 + 0.333 = 0.833$

From previous calculations

"Promethee 2" method provides a complete ranking, and requires the net outranking flow:

Calculate the net outranking flow "$\phi(a)$" for each alternative:

In general: $\phi(a) = \phi^+(a) - \phi^-(a)$

$\phi(A_1) = \phi^+(A_1) - \phi^-(A_1) = 1 - 0.333 = 0.667$

$\phi(A_2) = \phi^+(A_2) - \phi^-(A_2) = 0.667 - 0.689 = -0.167$

$\phi(A_3) = \phi^+(A_3) - \phi^-(A_3) = 0.189 - 0.833 = -0.644$

The complete ranking according to promethee 2 is A_1 , A_2 , A_3