Answers to exercises of Chapter 10 (Metabolic Networks)

Solution of Exercise 3 in Chapter 10
There are 8 Elementary flux modes (EFMs) in Figure 10.10a.

EFMs	R1	R2	R3	R4	R5	R6	R7	R8	R9
EFM1	1	0	1	0	1	0	-1	1	0
EFM2	1	0	1	1	0	0	0	1	0
EFM3	2	0	1	0	1	1	0	0	1
EFM4	2	0	1	1	0	1	1	0	1
EFM5	1	1	1	0	0	1	1	0	1
EFM6	1	-1	0	1	0	0	0	0	0
EFM7	1	-1	0	0	1	0	-1	0	0
EFM8	0	1	1	0	0	0	0	1	0

There are 6 Extreme pathways (EPs) in Figure 10.10b.

EPs	R1	R2	R3	R4	R5	R6	R7f	R7b	R8	R9
EP1	2	0	1	0	1	1	0	0	0	1
EP2	1	1	1	0	0	1	1	0	0	1
EP3	1	-1	0	1	0	1	0	0	0	0
EP4	1	-1	0	0	1	0	0	1	0	0
EP5	0	1	1	0	0	0	0	0	1	0
EP6	0	0	0	0	0	0	1	1	0	0

If only Aext and Bext are considered as external metabolites, the number of EFMs in Figure 10.10a is reduced to two (EFM6 and 7), in which R3 doesn't participate.

If only Aext and Bext are considered as external metabolites, the number of EPs in Figure 10.10b is reduced to three (EP3, 4 and 6), in which R3 doesn't participate.

The selection of external metabolites is extremely important in calculating EFMs and EPs as shown in this exercise. If a given external metabolite is ignored, all the corresponding EFMs and EPs, in which the given external metabolite participates, will not exist in theory.