Concurrency: State Models & Design Patterns

Practical Session

Week 01
Exercises 01

Preview
Exercise 01 - Task 1

a) Do recent central processing units (CPUs) of desktop PCs support concurrency? Why became concurrency for many software applications very important these days?

b) What is safety? Give one concrete example of a safety violation.

c) What is liveness? Give a concrete example of a liveness violation.

d) Using the implementation in the slides, can a binary semaphore lead to a deadlock? Can it lead to starvation? Explain with the aid of an example.

e) Why do we need synchronization mechanisms in concurrent programs?

f) How do monitors differ from semaphores? Please provide a precise answer.

g) How are monitors and message passing similar? And how are they different?
Exercise 01 - Task 2

x := 1
Thread 1 -> x := x + 7.
Thread 2 -> x := x * 5.

Considering the previous code, give all possible values of x at the end of the execution of both threads with their corresponding execution traces.
Exercise 01 - Task 3

Implement a monitor using semaphores. Use pseudo-code and comment it.