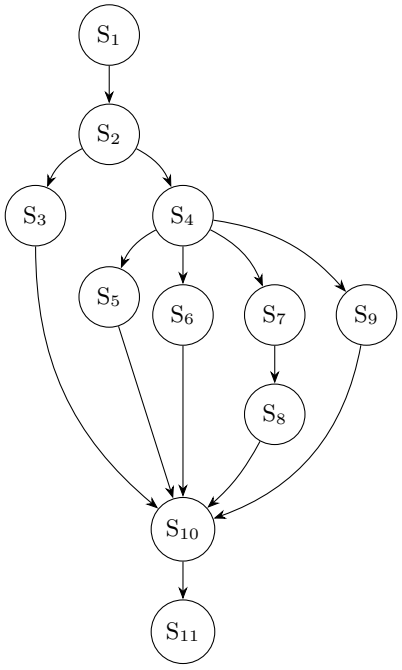
TD:1

Exercise 1:

Consider the precedence graph



1) Give the parallel program corresponding to the previous precedence graph using: i) the Fork and Join primitives; ii) the parbegin and parend primitives.

2) Give a simple example of a task system (in the form of a precedence graph) that cannot be described using the parbegin/parend primitives.

3) Give a simple example of a task system (in the form of a precedence graph) that cannot be described using the parbegin/parend primitives.

Exercise 2:

We want to write a parallel program that computes the following expression:

$$g * ((a + b)/(c - d) + (ef)) - (d - c)(a + b)$$

1) Give the precedence graph, specifying the tasks you consider (a task is a computational instruction).

2) Give the corresponding program using the PARBEGIN and PAREND primitives that best respects the precedence graph.

3) Give the corresponding program using the fork and join primitives.

Exercise 3:

Let E be the set of the following 5 tasks:

- T1: read(a);
- T2: read(b);
- T3: a := a + b;
- T4: c := a + b;

- T5: print c;

The task system S = (E, <) where T1 < T3, T1 < T4, T2 < T3, T2 < T4, and T4 < T5.
w is the behavior « d1 f1 d2 f2 d3 f3 d4 f4 d5 f5 »
w' is the behavior « d1 f1 d2 f2 d4 d3 f4 f3 d5 f5 »
During T1 the value α is read, during T2 the value β is read.

Q1) Determine V (C1, w) - the sequence of values written to a for behavior w.

Q2) Determine V (C2, w) - the sequence of values written to b for behavior w.

Q3) Determine V (C3, w) - the sequence of values written to c for behavior w.

Q4) Give the sequence of system states for behavior w' knowing that the initial state s0 is (a=0, b=0, c=0).

Q5) Is the system S deterministic?

Q6) Indicate the read and write domains of the different tasks (the sets R_i and W_i for each task i $\in$ [1, 5]).

Q7) Give the pairs of tasks that do not satisfy Bernstein's conditions.

Exercise 4:

A system of tasks with maximal parallelism is a deterministic system whose precedence graph G verifies the property: "the removal of any arc (T, T') from graph G leads to the interference of tasks T and T' (i.e., Bernstein's conditions are no longer satisfied, making the system non-deterministic)."

Consider the following three task systems S1, S2, S3:

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T1: a = 4;
T2: b = 5;
T3: c = a + 1;
T4: d = a + b;
T5: e = b + c + d;
T6: f = e + c;
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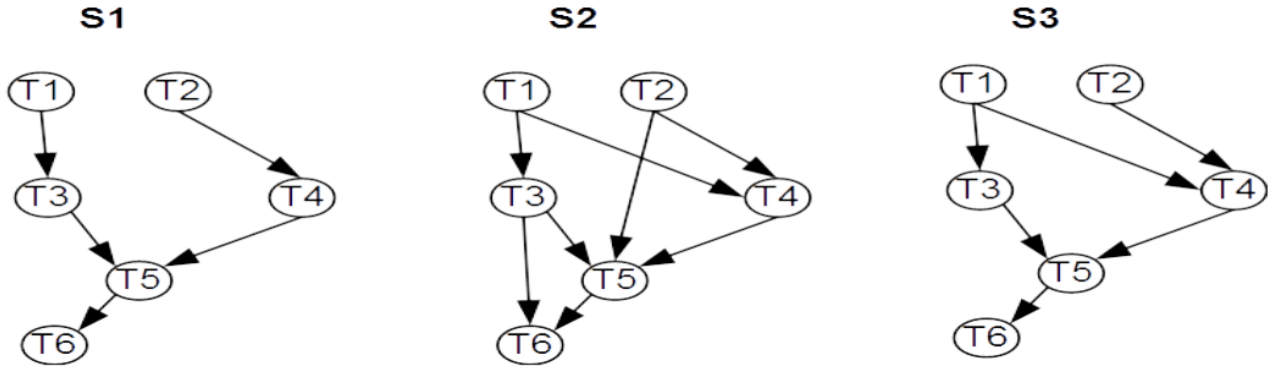

1. Are these systems deterministic? (Justify)
2. Are these systems of maximal parallelism? (Justify)
3. Construct the corresponding maximal parallelism graph?

Note: To construct the maximal parallelism graph, follow these steps:

1. If Bernstein's conditions are not satisfied between two tasks T and T', create an arc in the graph between the two tasks.
2. After constructing the precedence graph, eliminate all redundant arcs (via transitivity).