Larbi Ben M'hidi University – Oum El Bouaghi

Faculty of Exact Sciences and Nature and Life Sciences

Department of Mathematics and Computer Science

Module: Operating Systems II

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Tutorials Series 1

Exercise 1: Questions

1. What is the difference between a multiprocess system, a multiprocessor system, and a distributed system?
2. What is the difference between a real-time system and a batch system?
3. What system call in Linux is used to terminate a process?
4. Why is memory management crucial in an operating system?
5. What is a lightweight process (or thread), and how does it differ from a regular process?
6. What are the advantages of using threads in server applications compared to separate processes?
7. Is there a limit to the size of a thread in a process? If so, what is it?
8. What system call in Unix creates a child process?
9. Does a thread have access to all the resources of an operating system, such as the CPU and memory?
10. When is mutual exclusion used in an operating system?

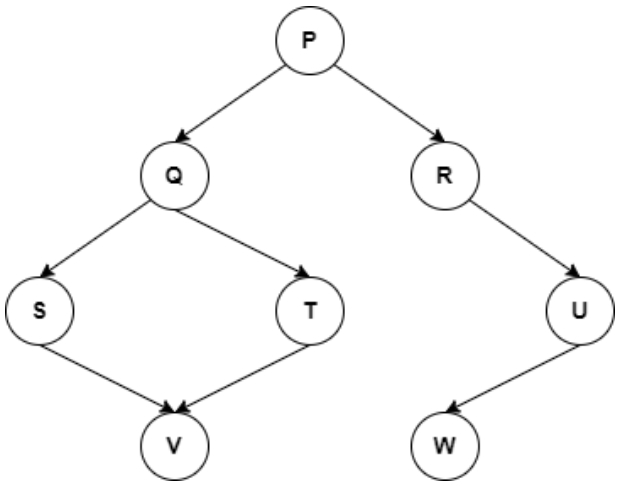
Exercise 2:

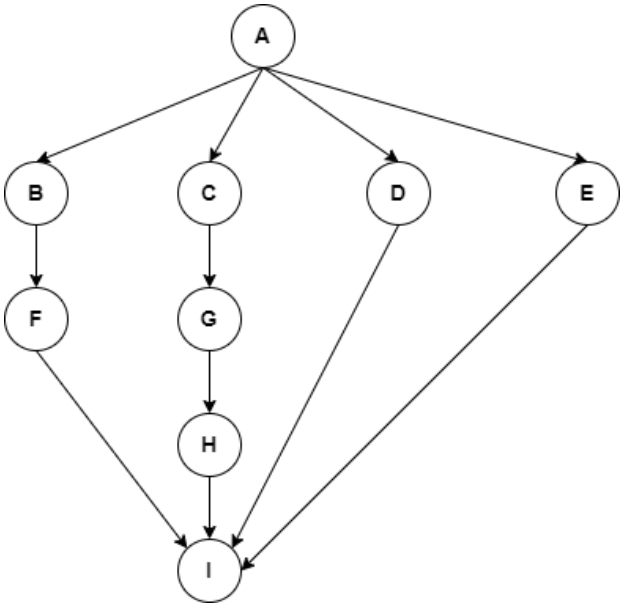
Provide the precedence graph for the following code:

```
Read (a)
Read (b)
Read (c)
x = a+b
y = a*a
z = c - 4
z = z – a
t = x + y
```

Exercice 3 :

Consider the following two precedence graphs:





- Write the corresponding code for each graph, taking into account the parallelization of tasks (ParBegin and ParEnd).

Exercice 4 :

The following code contains two functions in C.

```
int tab[15000];

void f1 (){
   int i;
   for(i=0; i<7500; i++) {
      tab[i] = tab[i] + 1;
   }
}
```

```
void f2() {
   int i;
   for(i=7500; i<15000; i++) {
      tab[i] = tab[i] + 2;
   }
}
```

Given that all elements of the array tab are initialized to zero, provide its contents after the execution of the two functions has finished in the following three cases:

a) The two functions run in two different processes.
b) The two functions run in two threads of the same process.
c) The two functions run in two threads of two different processes.

Exercice 5 :

Provide the precedence graph corresponding to the following pseudo-code:

```
Begin
   A
   ParBegin
      Begin
         B
         C
      End
      Begin
         D
         E
         F
      End
      G
      H
   ParEnd
   I
End
```

Exercice 6 :

1- We want to write a parallel program that calculates the following expression:

$$S = ((a+b) \times (c-d) + \frac{e}{f}) - (d+a) * (c-b)$$

- Provide the corresponding precedence graph.
- Provide the corresponding program using the primitives $fork$ and $join$.

2- Consider the task system $S = (E, <)$ with E being the following task set:

$T1: read(a)$
$T2: read(b)$
$T3: a = a + b$
$T4: c = a + b$
$T5: print(c)$

- The precedence relations are: $T1 < T3, T1 < T4, T2 < T3, T2 < T4$, et $T4 < T5$.
- w is the behavior: $d1\ f1\ d2\ f2\ d3\ f3\ d4\ f4\ d5\ f5$
- w' is the behavior: $d1\ f1\ d2\ f2\ d4\ d3\ f4\ f3\ d5\ f5$

a- Indicate the reading and writing domains of the 5 tasks.
b- Given that the initial state $S0$ est $(a = 0, b = 0, c = 0)$ provide in a table the sequence of states of S where the following are indicated:
   - the sequences of values $V(a, w)$, $V(b, w)$ et $V(c, w)$ written in a, b, and c respectively according to the behavior w.
   - the sequences of values $V(a, w')$, $V(b, w')$ et $V(c, w')$ written in a, b, and c respectively according to the behavior w'.
c- Is the system S determined?

Exercice 7 :

Verify whether each of the task systems S1, S2 and S3 shown below is in maximum parallelism:

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