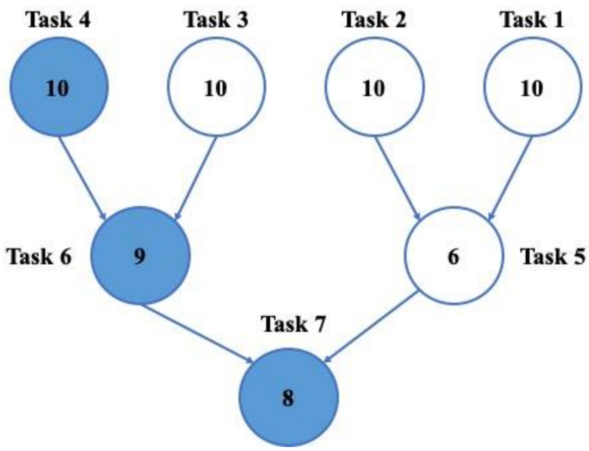
Práctica V - Ejercicios - Modelos de Descomposición de Programas Paralelos

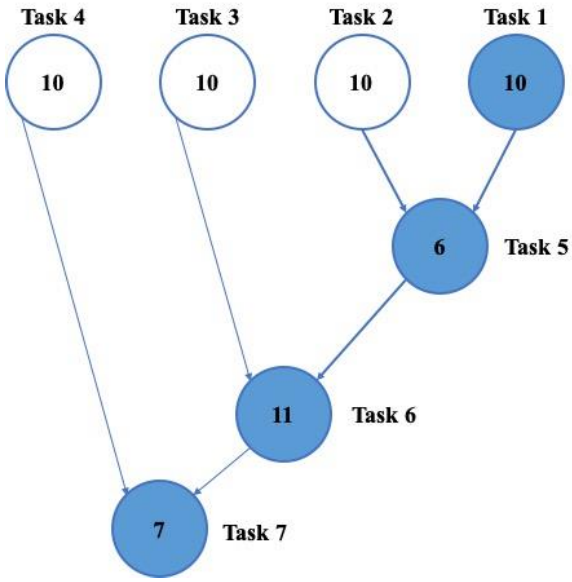
Problema 3.1

Task-dependency graph corresponding to figure 3.2



Critical path (colored in blue) length: 27
Total amount of work: 63
Average degree of concurrency = 63/27 = 2.33

Task-dependency graph corresponding to figure 3.3



Critical path (colored in blue) length: 34
Total amount of work: 64
Average degree of concurrency = 64/34 = 1.88

<u>Problema 3.2</u>
***Asignándole a cada nodo un peso de 1**

A.
1. Maximum degree of concurrency: 8
2. Critical path length: 4
3. Maximum achievable speedup over one process assuming that an arbitrarily large number of processes is available: 15/4
4. Minimum number of processes needed to obtain the maximum possible speedup: 8
5. Maximum achievable speedup if the number of processes is limited to (a) 2 = 15/8, (b) 4 = 3, and (c) 8 = 15/4.

B.
1. Maximum degree of concurrency: 8
2. Critical path length: 4
3. Maximum achievable speedup over one process assuming that an arbitrarily large number of processes is available: 15/4
4. Minimum number of processes needed to obtain the maximum possible speedup: 8
5. Maximum achievable speedup if the number of processes is limited to (a) 2 = 15/8, (b) 4 = 3, and (c) 8 = 15/4.

C.
1. Maximum degree of concurrency: 8
2. Critical path length: 7
3. Maximum achievable speedup over one process assuming that an arbitrarily large number of processes is available: 2
4. Minimum number of processes needed to obtain the maximum possible speedup: 3
5. Maximum achievable speedup if the number of processes is limited to (a) 2 = 7/4, (b) 4 = 2, and (c) 8 = 2.

D.
1. Maximum degree of concurrency: 8
2. Critical path length: 8
3. Maximum achievable speedup over one process assuming that an arbitrarily large number of processes is available: 15/8
4. Minimum number of processes needed to obtain the maximum possible speedup: 2
5. Maximum achievable speedup if the number of processes is limited to (a) 2 = 15/8, (b) 4 =15/8, and (c) 8 = 15/8.

<u>Problema 3.3</u>
For matrix multiplication shown in figure 3.10
***4 independent tasks**
Average degree of concurrency: 4
Critical path length: 1

For matrix multiplication shown in figure 3.11
***8 tasks (where each even numbered task depends on the previous)**
Average degree of concurrency: 4
Critical path length: 2

<u>Problema 3.4</u>

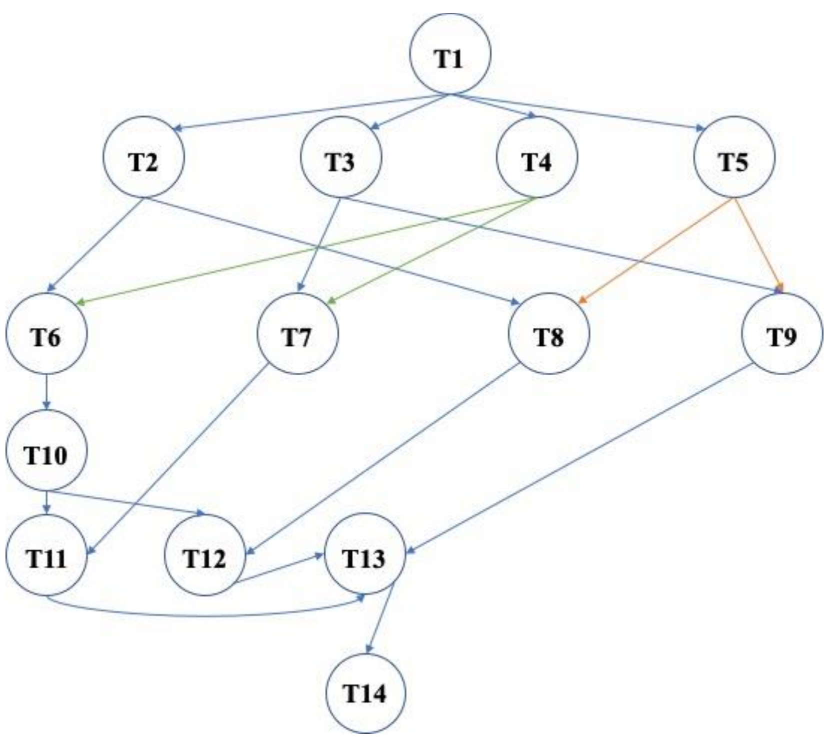
Tomando *l* como la ruta crítica del árbol, sabemos que no existe algún otro camino más largo. Por lo tanto, para contener todos los nodos del árbol necesitamos al menos *t/l* caminos; de manera que d ha ser mayor o igual a *t/l.* Si *d* fuera mayor que *t – l + 1*, no pudieramos tener una ruta crítica de longitud *l* porque nos harían falta *l - 1* más nodos para poder tenerla. Por lo que se demuestra la proposición del enunciado.

<u>Problema 3.5</u>

Figure 3.27. A decomposition of LU factorization into 14 tasks.

$$\begin{pmatrix} A_{1,1} & A_{1,2} & A_{1,3} \\ A_{2,1} & A_{2,2} & A_{2,3} \\ A_{3,1} & A_{3,2} & A_{3,3} \end{pmatrix} \rightarrow \begin{pmatrix} L_{1,1} & 0 & 0 \\ L_{2,1} & L_{2,2} & 0 \\ L_{3,1} & L_{3,2} & L_{3,3} \end{pmatrix} \cdot \begin{pmatrix} U_{1,1} & U_{1,2} & U_{1,3} \\ 0 & U_{2,2} & U_{2,3} \\ 0 & 0 & U_{3,3} \end{pmatrix}$$

1: $A_{1,1} \rightarrow L_{1,1}U_{1,1}$	6: $A_{2,2} = A_{2,2} - L_{2,1}U_{1,2}$	11: $L_{3,2} = A_{3,2}U_{2,2}^{-1}$
2: $L_{2,1} = A_{2,1}U_{1,1}^{-1}$	7: $A_{3,2} = A_{3,2} - L_{3,1}U_{1,2}$	12: $U_{2,3} = L_{2,2}^{-1}A_{2,3}$
3: $L_{3,1} = A_{3,1}U_{1,1}^{-1}$	8: $A_{2,3} = A_{2,3} - L_{2,1}U_{1,3}$	13: $A_{3,3} = A_{3,3} - L_{3,2}U_{2,3}$
4: $U_{1,2} = L_{1,1}^{-1}A_{1,2}$	9: $A_{3,3} = A_{3,3} - L_{3,1}U_{1,3}$	14: $A_{3,3} \rightarrow L_{3,3}U_{3,3}$
5: $U_{1,3} = L_{1,1}^{-1}A_{1,3}$	10: $A_{2,2} \rightarrow L_{2,2}U_{2,2}$	



Problema 3.6

a) 1, 2, 6, 10, 11, 13, 14
b) 1, 2, 6, 10, 12, 13, 14
c) 1, 4, 6, 10, 11, 13, 14
d) 1, 4, 6, 10, 12, 13, 14

Problema 3.7

	P0	*P1*	*P2*
1	1		
2	2	4	3
3	5	6	8
4	7	10	9
5	12	11	
6	13		
7	14		

Problema 3.8

	P0	*P1*	*P2*	*P3*
1	1			
2	2	5	4	3
3	6	7	8	9
4	10			
5	11	12		
6	13			
7	14			