

5. Arbres phylogénétiques

- L'arbre des espèces
- L'arbre, objet abstrait
- Remplir un tableau de distances
- **L'algorithme UPGMA**
- Quand les différences sont trompeuses
- La diversité des algorithmes informatiques
- Les applications en microbiologie

UPGMA

- Unweighted Pair Group Method with Arithmetic Mean
- Un nom plutôt compliqué pour une méthode plutôt simple
- Le point de départ, un tableau de distances

	A	B	C	D	E
B	6				
C	4	6			
D	6	4	6		
E	8	8	8	8	
F	4	6	2	6	8

	A	B	C	D	E
B	6				
C	4	6			
D	6	4	6		
E	8	8	8	8	
F	4	6	2	6	8

	A	B	C	D	E
B	6				
C	4	6			
D	6	4	6		
E	8	8	8	8	
F	4	6	2	6	8



	A	B	C	D	E
B	6				
C	4	6			
D	6	4	6		
E	8	8	8	8	
F	4	6	2	6	8



$$\begin{aligned} \text{dist}(F,C),A &= (\text{dist } F,A + \text{dist } C,A) / 2 = 4 \\ \text{dist}(F,C),B &= (\text{dist } F,B + \text{dist } C,B) / 2 = 6 \\ \text{dist}(F,C),D &= (\text{dist } F,D + \text{dist } C,D) / 2 = 6 \\ \text{dist}(F,C),E &= (\text{dist } F,E + \text{dist } C,E) / 2 = 8 \end{aligned}$$

	(F C)	A	B	D	E
A	4				
B	6	6			
D	6	6	4		
E	8	8	8	8	



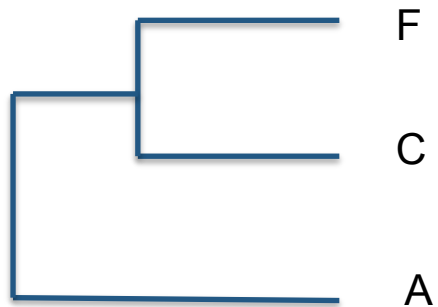
	(F C)	A	B	D	E
A	4				
B	6	6			
D	6	6	4		
E	8	8	8	8	



	(F C)	A	B	D	E
A	4				
B	6	6			
D	6	6	4		
E	8	8	8	8	



	(F C)	A	B	D	E
A	4				
B	6	6			
D	6	6	4		
E	8	8	8	8	



$((F\ C)\ A)$

$(D\ B)$

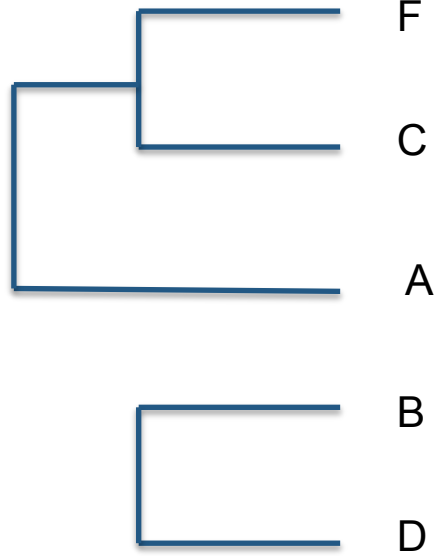
$(D\ B)$

6

E

8

8



$((F\ C)\ A)$

$(D\ B)$

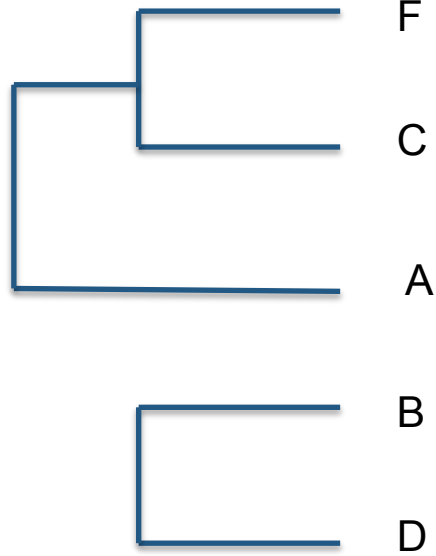
$(D\ B)$

6

E

8

8



$((F\ C)\ A)$

$(D\ B)$

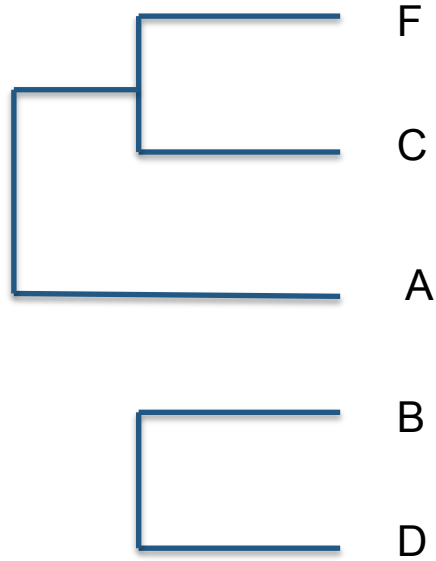
$(D\ B)$

6

E

8

8



$((F\ C)\ A)$

$(D\ B)$

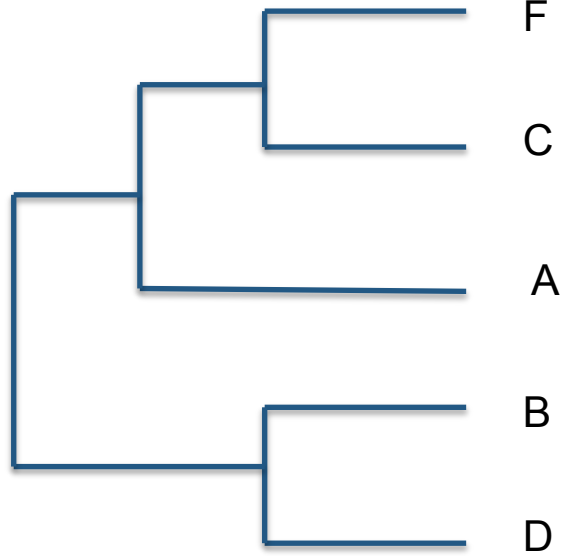
$(D\ B)$

6

E

8

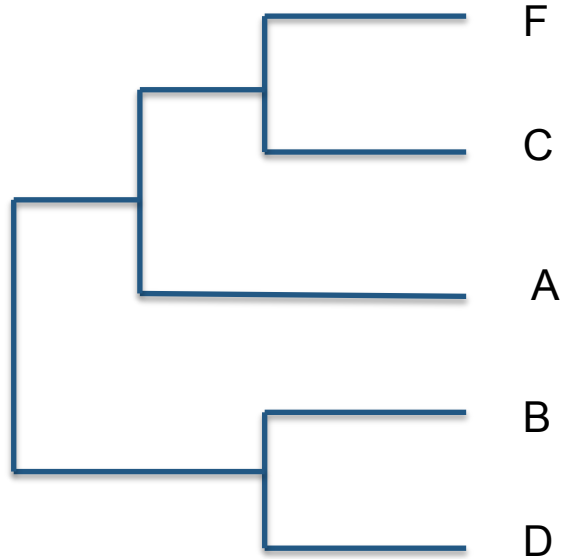
8



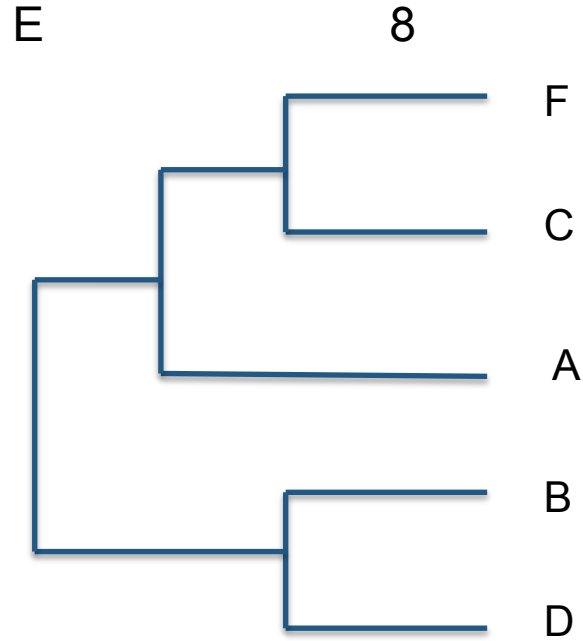
`dist (((F C) A)(D B)) E`

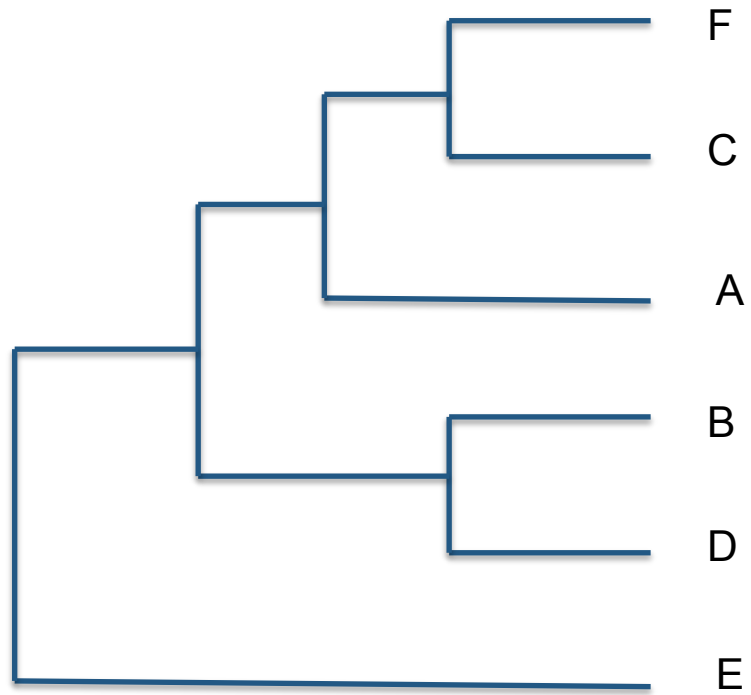
`= (dist ((F C) A) E + dist (D B) E) / 2`

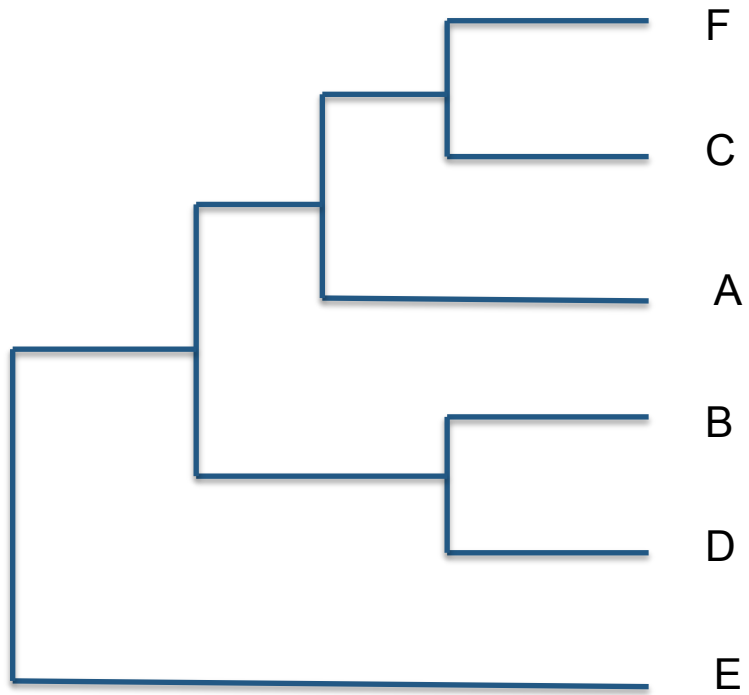
`= 8`



$((F\ C)\ A)\ (D\ B)$







$((F\ C)\ A\ (B\ D)\ E)$