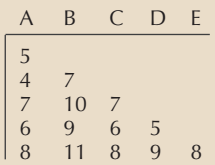
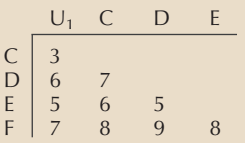
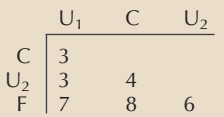
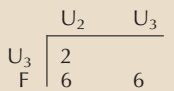
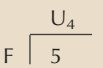
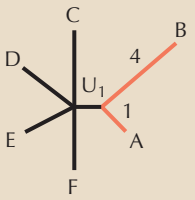
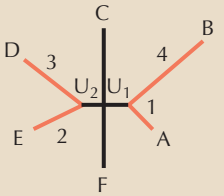
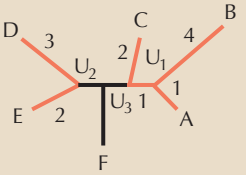
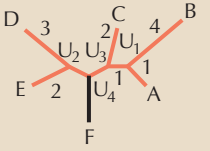
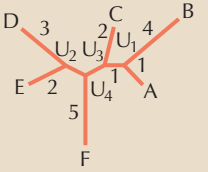
TABLE 27.11. Neighbor-joining example

	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
Distance matrix					
Step 1					
S calculations S_x = (sum all D_x)/(N – 2), where N is the # of OTUs in the set.	S_A = (5+4+7+6+8)/4 = 7.5 S_B = (5+7+10+9+11)/4 = 10.5 S_C = (4+7+7+6+8)/4 = 8 S_D = (7+10+7+5+9)/4 = 9.5 S_E = (6+9+6+5+8)/4 = 8.5 S_F = (8+11+8+9+8)/4 = 11	S_{U_1} = (3+6+5+7)/3 = 7 S_C = (3+7+6=8)/3 = 8 S_D = (6+7+5+9)/3 = 9 S_E = (5+6+5+8)/3 = 8 S_F = (7+8+9+8)/3 = 10.6	S_{U_1} = (3+3+7)/2 = 6.5 S_C = (3+4+8)/2 = 7.5 S_{U_2} = (3+4+6)/2 = 6.5 S_F = (7+8+6)/2 = 10.5	S_{U_2} = (2+6)/1 = 8 S_{U_3} = (2+6)/1 = 8 S_F = (6+6)/1 = 12	Because N – 2 = 0, we cannot do this calculation.
Step 2					
Calculate pair with smallest (M), where $M_{ij} = D_{ij} - S_i - S_j$.	Smallest are M_{AB} = 5 – 7.5 – 10.5 = –13 M_{DE} = 5 – 9.5 – 8.5 = –13 Choose one of these (AB here).	Smallest is M_{CU_1} = 3 – 7 – 8 = –12 M_{DE} = 5 – 9 – 8 = –12 Choose one of these (DE here).	Smallest is M_{CU_1} = 3 – 6.5 – 7.5 = –11	Smallest is M_{U_2F} = 6 – 8 – 12 = –14 M_{U_3F} = 6 – 8 – 12 = –14 $M_{U_2U_3}$ = 2 – 8 – 8 = –14 Choose one of these ($M_{U_2U_3}$ here).	
Step 3					
Create a node (U) that joins pair with lowest M_{ij} such that $S_{IU} = D_{ij}/2 + (S_i - S_j)/2$.	U_1 joins A and B: $S_{AU_1} = D_{AB}/2 + (S_A - S_B)/2 = 1$ $S_{BU_1} = D_{AB}/2 + (S_B - S_A)/2 = 4$	U_2 joins D and E: $S_{DU_2} = D_{DE}/2 + (S_D - S_E)2 = 3$ $S_{EU_2} = D_{DE}/2 + (S_E - S_D)/2 = 2$	U_3 joins C and U_1: $S_{CU_3} = D_{CU_1}/2 + (S_C - S_{U_1})/2 = 2$ $S_{U_1U_3} = D_{CU_1}/2 + (S_{U_1} - S_C)/2 = 1$	U_4 joins U_2 and U_3: $S_{U_2U_4} = D_{U_2U_3}/2 + (S_{U_2} - S_{U_3})/2 = 1$ $S_{U_3U_4} = D_{U_2U_3}/2 + (S_{U_3} - S_{U_2})/2 = 1$.	For last pair, connect U_4 and F with branch length = 5.
Step 4					
Join i and j according to S above and make all other taxa in form of a star. Branches in black are of unknown length. Branches in red are of known length.					
Step 5					**Comments**
Calculate new distance matrix of all other taxa to U with $D_{xU} = D_{ix} + D_{jx} - D_{ij}$, where i and j are those selected from above.					Note this is the same tree we started with (drawn in unrooted form here).

From http://www.icp.ucl.ac.be/~opperd/private/upgma.html.