

Objective 2 - construct a phylogenetic tree using UPGMA algorithm

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$$* d(ab, c) = \frac{|a| \cdot d(a, c) + |b| \cdot d(b, c)}{|a| + |b|}$$

	a	b	c	d	e	f
a	0	15	24	29	25	37
b		0	32	31	23	43
c			0	30	43	49
d				0	45	57
e					0	55
f						0

$$\rightarrow d(ab, c) = \frac{1 \cdot 24 + 1 \cdot 32}{1+1} = 28$$

$$d(ab, d) = \frac{1 \cdot 29 + 1 \cdot 31}{1+1} = 30$$

$$d(ab, e) = \frac{1 \cdot 25 + 1 \cdot 23}{1+1} = 24$$

$$d(ab, f) = \frac{1 \cdot 37 + 1 \cdot 43}{1+1} = 40$$

	ab	c	d	e	f
ab	0	28	30	24	40
c		0	30	43	49
d			0	45	57
e				0	55
f					0

$$\rightarrow d(ab(e), c) = \frac{2 \cdot 28 + 1 \cdot 43}{2+1} = 33$$

$$d(ab(e), d) = \frac{2 \cdot 30 + 1 \cdot 45}{2+1} = 35$$

$$d(ab(e), f) = \frac{2 \cdot 40 + 1 \cdot 55}{2+1} = 45$$

	abe	c	d	f
abe	0	33	35	45
c		0	30	49
d			0	57
f				0

$$\rightarrow d(cd, abe) = \frac{1 \cdot 33 + 1 \cdot 35}{1+1} = 34$$

$$d(cd, f) = \frac{1 \cdot 49 + 1 \cdot 57}{1+1} = 53$$

	abe	cd	f
abe	0	34	45
cd		0	53
f			0

$$\rightarrow d((abe)(cd), f) = \frac{3 \cdot 45 + 2 \cdot 53}{3+2} = 48.2$$

	abecd	f
abecd	0	48.2
f		0

