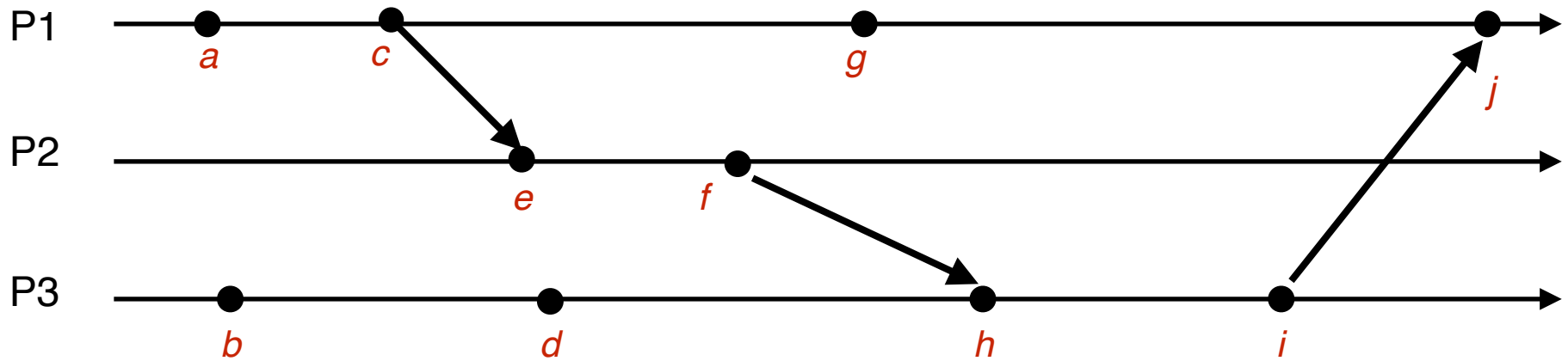


Logical Clocks

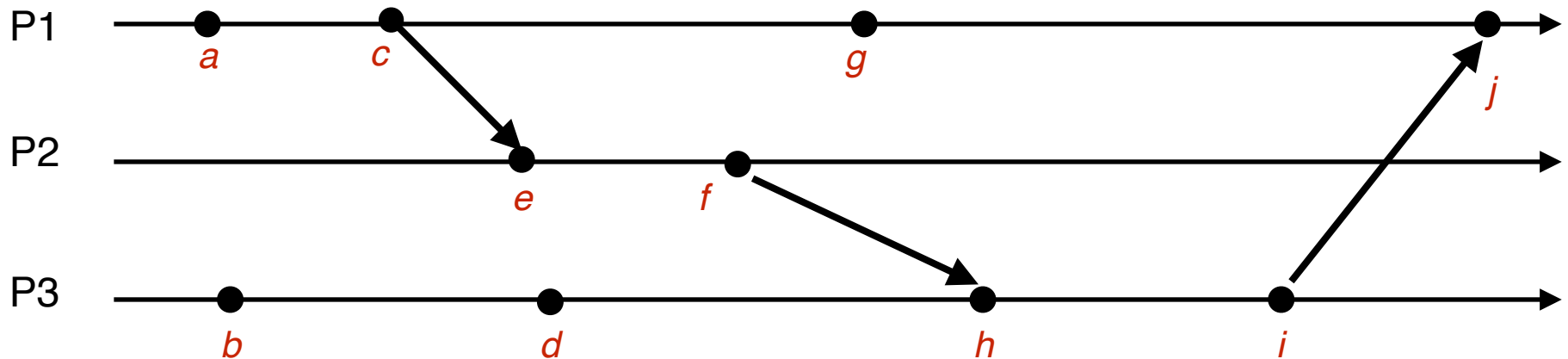
1. Lamport Clocks

Annotate the process timelines with Lamport clocks for each event.



2. Vector Clocks

Annotate the process timelines with Vector clocks for each event.



Using your vector clocks, indicate whether an event happens before (\rightarrow), after (\leftarrow) or is concurrent (\parallel)

a _____ *b*

c _____ *i*

d _____ *f*

b _____ *h*

g _____ *h*

e _____ *d*

f _____ *j*

b _____ *g*

b _____ *j*

3. Comparing Clocks

Given this set of events and vector clocks for four processes, specify the relationship between each event.

P1	P2	P3	P4
a: 1,0,0,0	e: 1,1,0,0	i: 0,0,1,0	l: 0,0,0,1
b: 2,0,0,0	f: 1,2,0,1	j: 0,0,2,2	m: 0,0,0,2
c: 3,0,0,0	g: 1,3,0,1	k: 0,0,3,2	n: 0,0,0,3
d: 4,2,0,1	h: 1,4,3,2		

a _____ *f*

m _____ *g*

l _____ *c*

m _____ *h*

g _____ *k*

b _____ *g*