Consider a fair-queuing server where there are three flows, f, g, and h, all with fixed packet sizes of 1000 bits, and the output channel bandwidth is 100 bits/sec.

Assume at real-time 0 packet f,1 arrives.

Then packet g,1 arrives at real-time 6 sec.

Packet h,1 arrives at real-time 9sec,

And finally, packet f,2 arrives at time 19.5

For every packet
a) Show me its F value, i.e. , the fake time of the finishing time of the packet in the fake server.
b) Show me the *real time* of when the packet exits the *real* server.
Part a)

F(f,1) = max(0, V(A(f,1)) + 1000 = 0 + 1000 = 1000

A(g,1) = 6 seconds

F(g,1) = max(0, V(A(g,1)) + 1000 = max(0, **V(6)**) + 1000

Thus, 600 bits were xmitted from A(f,1) to A(g,1). Only f was queued, i.e., 600 rounds.

Thus, V(A(g,1)) = V(6) = 600

F(g,1) = max(0, V(A(g,1)) + 1000 = 600 + 1000 = 1600

A(h,1) = 9

F(h,1) = max(0, V(A(h,1)) + 1000 = max(0, **V(9)**) + 1000

V(6) = 600 (from above), what is V(9)?

In 3 seconds, server transmits 300 bits, and since both f and g are queued starting at V(6), then 150 rounds occur

I.e., V(9) = 600 + 150 = 750. This is true provided neither f nor g finish sending their last bit. Flow f will finish in round 1000 and g in round 1600, so it is true

F(h,1) = max(0, V(A(h,1)) + 1000 = max(0, V(9)) + 1000 = 1750

A(f,2) = 19.5

F(f,2) = max(F(f,1), V(A(f,2)) + 1000 = max(1000, **V(19.5)**) + 1000

What is V(19.5)?

V(9) = 750, from 9 sec to 19.5 sec we have 10.5 sec, i.e., 1050 bits transmitted. If all f, g, and h are queued, then these are 1050/3 = 350 rounds. So, the round number would be 750 + 350 = 1100. Obviously f,1 will finish before this, at round F(f,1) = 1000, so there is a "change in slope" for V at round 1000.

V(9) = 750, V(x) = 1000 (when f,1 finishes). What is x? Well, 250 rounds, 3 queued flows gives 750 bits, or 7.5 more seconds, so x = 9 + 7.5 = 16.5

V(16.5) = 1000 and only g and h remain queued, so the slope of V changes.

Again, what is V(19.5)? From 16.5 to 19.5 there are 3 seconds, 300 bits, two queued flows, so 150 rounds. V(19.5) = V(16.5) + 150 = 1000 + 150 = 1150. This is PROVIDED neither g nor h finish. Flow g finishes at round 1600, so it is indeed true

V(19.5) = 1150.

F(f,2) = max(F(f,1), V(A(f,2)) + 1000 = max(1000, V(19.5)) + 1000 = max(1000,1150) + 1000 = 1150 + 1000 = 2150

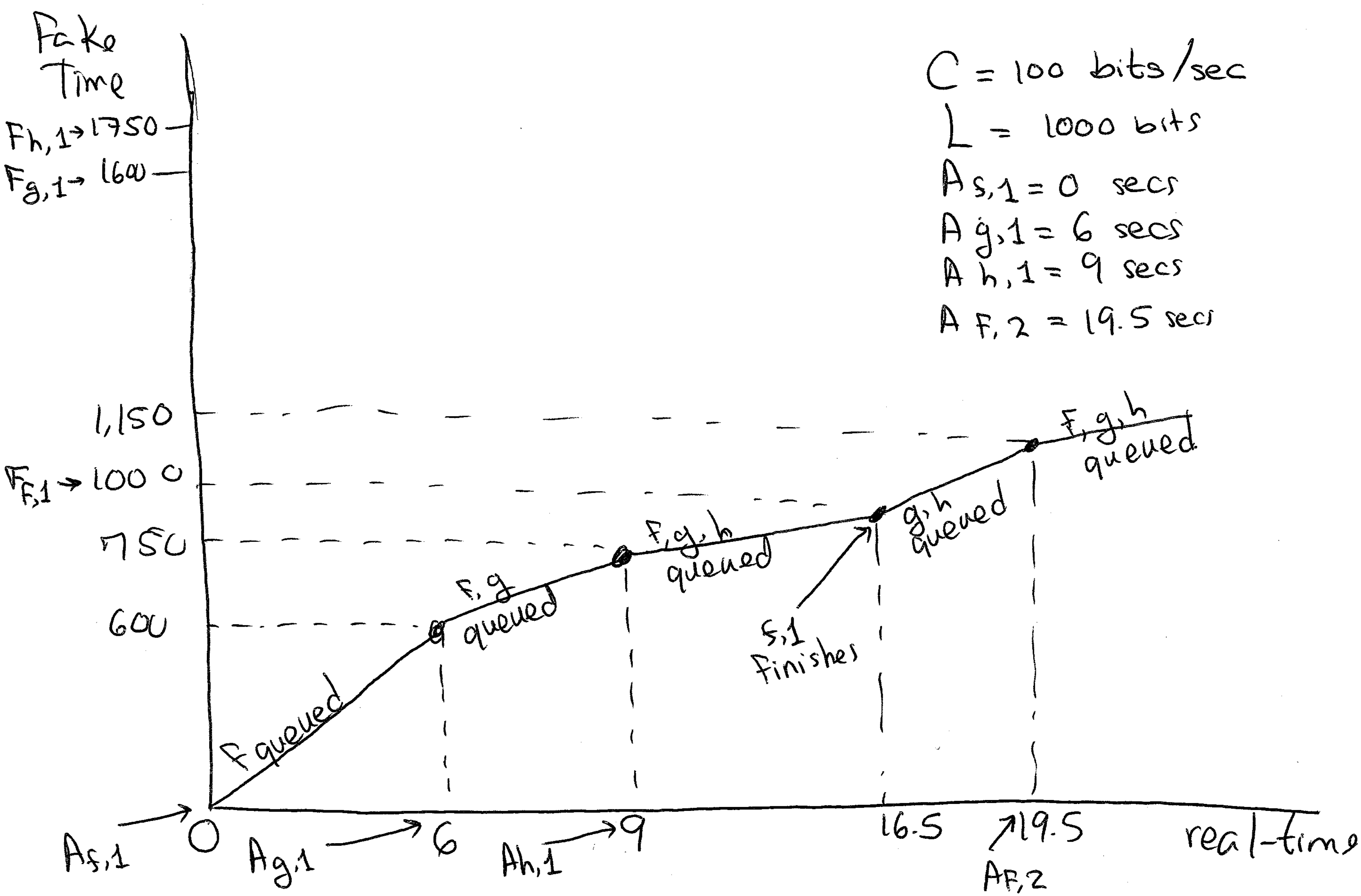
Part b))

f,1 is sent first, and finishes at real-time 1000/100 = 10 seconds.

By time 10, both g,1 and h,1 have arrived, so the next one to xmit at time 10 is g,1, and it exits at time 10 + 1000/100 = 10 + 10 = 20.

At time 20, h,1 remains, and f,2 has arrived, h.1 has smaller timestamp so it is transmitted. It finishes at time 30

At time 30 f.2 is transmitted and ends at time 40.



Fake Time
$F_{h,1} \rightarrow 1750$
$F_{g,1} \rightarrow 1600$
$C = 100$ bits/sec
$L = 1000$ bits
$A_{s,1} = 0$ secs
$A_{g,1} = 6$ secs
$A_{h,1} = 9$ secs
$A_{f,2} = 19.5$ secs
1,150
$F_{f,1} \rightarrow 1000$
750
600
f queued
f, g queued
f, g, h queued
f,1 finishes
g, h queued
f, g, h queued
$A_{f,1}$
0
$A_{g,1}$
6
$A_{h,1}$
9
16.5
19.5
$A_{f,2}$
real-time