20 POINTS

4. The following information depicts a system consisting of 3 processes (**a, b, and c**) and **10 tape drives** which the processes must share. The system is currently in a **"safe"** state with respect to deadlock:

process	max tape demand	current allocation	outstanding claim
a	4	2	2
b	6	2	4
c	8	4	4

free 3

Following is a sequence of events each of which occurs a short time after the previous event with the first event occurring at time zero. The exact time that each event occurs is not important except that each is later than the last. I have marked the times **t(1), t(2),** etc. for reference. Each event either **requests or releases** some tape drives for one of the processes. If a system must be kept **"safe"** at all times, and if a request can only be met by providing all the requested drives, indicate the time at which each request will be granted using a **first-come-first-served** method for any processes that may have to wait for their request (i.e. request 5 granted at t(9)) or indicate that a request will not be granted any time in the sequential time listed. (Note: if a process releases some drives at time(x) which a waiting process needs, that waiting process will get its drives **at that time(x).** Put your final answers in the space provided below.

TIME		ACTION
t(1)	request #1	c requests 2 drives ~~wait~~ wait
t(2)	request #2	a requests 2 drives ✓
t(3)	release	a releases 3 drives
t(4)	request #3	b requests 3 drives ✓
t(5)	request #4	a requests 1 drive ✓
t(6)	release	b releases 4 drives
t(7)	request #5	b requests 1 drive wait
t(8)	release	a releases 1 drive

ANSWERS:

proc	max	current	diff
a	4	1	3
b	6	2	4
c	8	4	4

free 3

Request #1 granted at t(6)

Request #2 granted at t(2)

Request #3 granted at t(4)

Request #4 granted at t(5)

Request #5 granted at never