-4

20 POINTS

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

thread	max tape demand	current allocation	outstanding claim
a	4	2	2
b	6	3	3
c	8	2	6

Following is a sequence of events, each of which happens a short time after the previous event, with the first event occurring at time zero. 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 threads. If this 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 threads that may have to wait for their request (i.e. request 5 granted at t(x)) or indicate that a request will not be granted any time in the sequential time listed. (Note: if a thread releases one or more drives at time(x) that a waiting thread wants, that waiting thread will get its drives **at that time(x),** provided the system remains in a safe state). Put your final answers in the space provided below.

10
(3/10)

TIME	ACTION	
t(1)	request #1 Y	a requests 1 drive (2/10)
t(2)	request #2 N	c requests 2 drives (2/10)
t(3)	release	b releases 1 drive (3/10)
t(4)	request #3 Y	a requests 1 drive (0/10)
t(5)	release	c releases 2 drives (2/10)
t(6)	release	a releases 1 drive (3/10)
t(7)	request #4 N	b requests 3 drives (3/10)
t(8)	request #5	c requests 2 drive (1/10)
t(9)	release	a releases 2 drives (3/10)

th	max	current	balance
a	4	1	3
b	6	2	4
c	8	4	4

ANSWERS:

Request #1 granted at t(1)

Request #2 granted at ~~t(4)~~ 3

Request #3 granted at t(4)

Request #4 granted at X

Request #5 granted at t(8)