

1 Tape drives (10 pts.)

1.1 3 pts

Is the following state safe? Why or why not?

This state is safe. One safe sequence is A (needs 1, can be satisfied using the currently-free tape drive), C (needs 2, will have 2), B (needs 1, will have 2). There are other safe sequences.

1.2 3 pts

Explain why the following state is not safe.

There is no safe sequence because the following situation is true for each process in the system: it is allowed to request one more tape drive, but there are no tape drives available, so it cannot necessarily proceed to completion with the resources it holds plus the resources currently free.

Less formally, each process is allowed to request one tape drive; because there are none free, any such request must block; because every process is allowed to block in this fashion before releasing tape drives, any blocking can be permanent; if everybody blocks, everybody will be waiting for everybody else.

1.3 4 pts

Show a safe state in which three tape drives are allocated.

Who	Max	Has	Room
A	2	2	0
B	2	1	1
C	2	0	2
System	3	0	-

This state is safe because of the following safe sequence: A, C, B (again, this is not the only safe sequence).

2 Transfer trouble (10 pts.)

*Using the tabular format presented in class, show how concurrent invocations of the “mathematically safe” operation `transfer(A, A, 500)` can **increase** the amount of money in account A. For fun, see if you can get `transfer(A, A, 500)` to **double** the amount of money in the account.*

Execution Trace

time	Thread A	Thread B
0	a = 500	
1	if (...)	a = 500
2	a = 500	if (...)
3	f->v = a /*0*/	a = 500
4		f->v = a /*0*/
5	t->v += amount /*0=>500*/	
6		t->v += amount /*500=>1000*/

There are many other valid solutions—you can have fewer steps with more things “happening at the same time,” or more steps with fewer things “happening at the same time.”

In terms of difficulty, this homework is easier than typical exam questions on similar topics. However, this homework represents some of the reasoning we expect you to carry out in order to detect and explain race conditions (and/or deadlocks).