

Exercise. This is the solution to exercise 2.22 in the book.

Solution.

a. The user time plus system time is the total CPU time. Notice that the total time may be less than the wall clock time because the program may be idle at times (not in system or user calls). Hence,

$$u + s = r \leq t$$

b. In this case

$$u + s < r$$

so the difference

$$m = r - u - s$$

must be the time spent on messages (assuming idle time is not included in r).

c. The messaging time could be determined by running a different number of processes (a single process gives an estimate of the user time without messaging). Assume that system and user time (excluding messaging) scale in the same way when using multiple processes. Based on the single process user and system time as well as system time when using multiple processes, one could obtain the user time excluding messaging for multiple processes. From this value and the actual user time reported one could obtain then the messaging time.