14. **(a)** Processor 1: T_1, T_2, T_4, T_6, T_7.
Processor 2: idle 0 to 1, T_3, T_5, idle 3 to 5.

(b) Processor 1: T_1, T_2, T_4, T_5.
Processor 2: idle 0 to 1, T_3, T_6, T_7.

(c) The schedule in (b) is optimal.

15. T_1, T_2, T_3, T_4, T_8, T_9, T_{10}, T_{11}, T_5, T_6, T_7, T_{12}.

16. **(a)** The critical path, which has length 17, is T_1, T_2, T_3.

(b) T_1, T_4, T_5, T_2, T_6, T_7, T_3 is the list to be used. The one processor would have the tasks scheduled on it: T_1, T_4, T_5, T_2, T_6, T_7, T_3.

(c) T_6, T_1, T_7, T_2, T_4, T_3, T_5 would be the list. The resulting schedule on one processor would be: T_1, T_7, T_4, T_2, T_5, T_6, T_3.

(d) No idle time. Their completion times are the same.

(e) Earlier completion of tasks giving rise to cash payments.

(f) The required schedule is Processor 1: T_1, T_6, T_3; Processor 2: T_4, T_5, T_2, T_7.

(g) The completion time does halve $(40 \to 20)$. As the number of processors goes up, the completion time may decrease, but at some point the length of the critical path will govern the completion time rather than the number of processors.

(h) **(i)** Completion time goes down by 7.
(ii) Completion time is 19 for two processors using the decreasing time list.

17. **(a)** No. Consider the tasks that begin after the stretch where all machines are idle. Pick one of these tasks T and say machine 1 was the machine that it was given to. This task was ready for machine 1 just prior to when it began T because no task was just being completed on any other machine at this time because they were all idle. Thus, T should have begun earlier on machine 1.

(b) This schedule cannot arise using the list-processing algorithm, because T_2 should have been scheduled at time 0.

(c) Use the digraph with no edges and the list: T_2, T_1, T_3, T_4, T_5.

18. **(a)** 55 minutes.

(b) Mike: T_1, T_2, T_3, T_8, T_9.
Mary: T_4, T_7, T_5, T_6, idle 22–33.

(c) Mike: T_1, T_2, T_3, idle 20–21.
Mary: T_4, T_5, T_6.
Jack: T_7, T_8, T_9, idle 14–21.

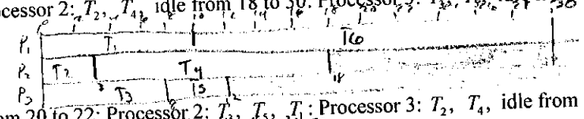
(d) Tasks that, when completed, result in hot food for eating should be completed as close to the end as possible.

19. **(a)** T_1, T_2, T_3, and T_6 are ready at time 0.

(b) No tasks require that T_1 and T_6 be done before these other tasks can begin.

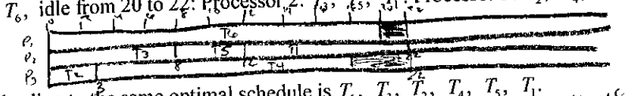
(c) The critical path consists only of T_6 and has length 20.

(d) Processor 1: T_1, T_6; Processor 2: T_2, T_4, idle from 18 to 30; Processor 3: T_3, T_5, idle from 12 to 30.



(e) No.

(f) Processor 1: T_6, idle from 20 to 22; Processor 2: T_2, T_5, T_1; Processor 3: T_3, T_4, idle from 18 to 22.

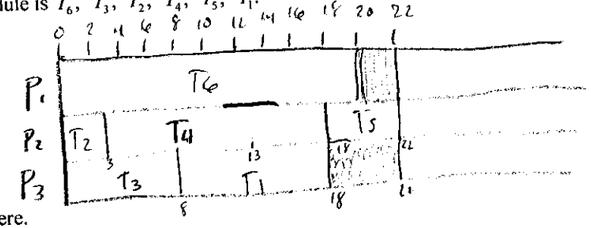


(g) Yes.

(h) Another list leading to the same optimal schedule is T_6, T_3, T_2, T_4, T_5, T_1.

20. **(a)** T_6, T_2, T_4, T_3, T_1, T_5.

(b) Processor 1: T_6, idle 20–22;
Processor 2: T_2, T_4, T_5;
Processor 3: T_3, T_1, idle 18–22.
This schedule is optimal for 3 processors.



(c) It is no better than the best schedule found there.

21. **(a)** $5! = 120$

(b) No. Whatever list is used, T