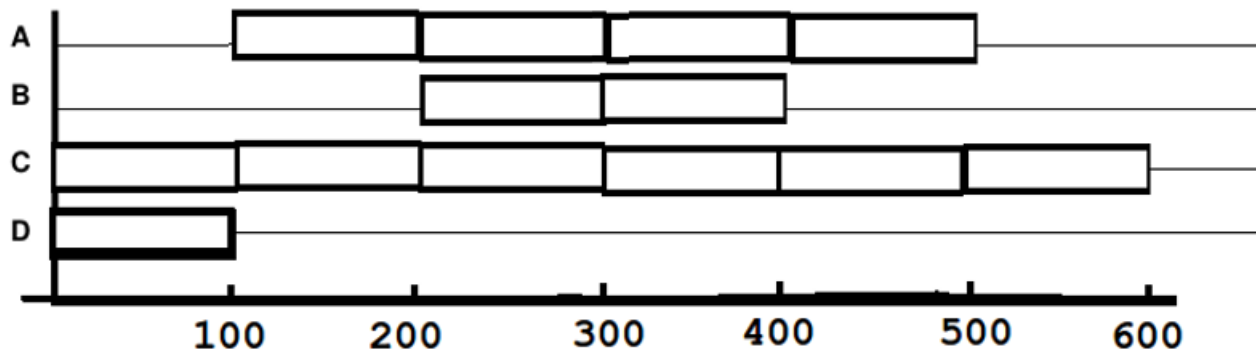


1. 2016-1

| | Kombinasi Multiprogram (%) | | | | | | | | | | | | | | |
|---------------------------|----------------------------|----|----|----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|---------|
| | A | B | C | D | A+B | A+C | A+D | B+C | B+D | C+D | A+B+C | A+B+D | A+C+D | B+C+D | A+B+C+D |
| Utilitas CPU per proses A | 10 | - | - | - | 9.3 | 9.3 | 9.2 | - | - | - | 8.3 | 8.1 | 7.8 | - | 7 |
| Utilitas CPU per proses B | - | 20 | - | - | 19 | - | - | 18 | 17 | - | 17 | 16 | - | 15 | 14 |
| Utilitas CPU per proses C | - | - | 30 | - | - | 28 | - | 26 | - | 25 | 25 | - | 23 | 22 | 21 |
| Utilitas CPU per proses D | - | - | - | 40 | - | - | 37 | - | 35 | 33 | - | 32 | 31 | 30 | 28 |

Diagram berikut ini dibentuk menggunakan data tabel di atas.



- Berapa waktu CPU (CPU TIME) dari proses "A"?
- Berapa waktu CPU (CPU TIME) dari proses "B"?
- Berapa waktu CPU (CPU TIME) dari proses "C"?
- Berapa waktu CPU (CPU TIME) dari proses "D"?
- Berapa waktu total (TOTAL TIME) dari proses "A"?
- Circle or cross "T" if true, and "F" if false:
[T / F] Priority scheduling prevents starvation.

2. 2016-2

There exists four (4) identical processes, with this following CPU utilization table:

| | Multiprogramming Combination (%) | | | |
|------------------------------|----------------------------------|-------|-----------|---------------|
| | A | A + A | A + A + A | A + A + A + A |
| CPU utilization per proses A | 10 | 9.5 | 9 | 8.6 |

The CPU time of each processes is 43 seconds

Print the output when the system runs:

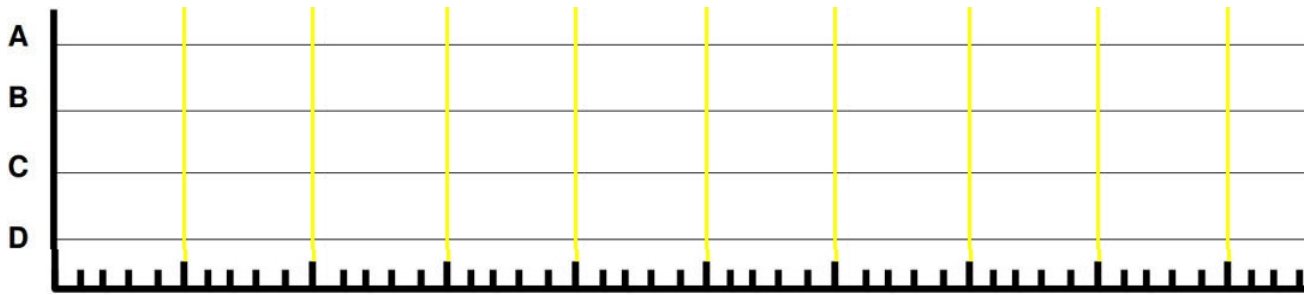
- How long will be the total time to run concurrently all (4) processes together?!
- How long will be the total time to run all (4) processes one by one?!

3. 2017-1

| | Kombinasi Multiprogram (%) | | | | | | | | | | | | | | |
|---------------------------|----------------------------|----|----|----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|---------|
| | A | B | C | D | A+B | A+C | A+D | B+C | B+D | C+D | A+B+C | A+B+D | A+C+D | B+C+D | A+B+C+D |
| Utilitas CPU per proses A | 10 | - | - | - | 9.3 | 9.3 | 9.2 | - | - | - | 8.3 | 8.1 | 7.8 | - | 7 |
| Utilitas CPU per proses B | - | 20 | - | - | 19 | - | - | 18 | 17 | - | 17 | 16 | - | 15 | 14 |
| Utilitas CPU per proses C | - | - | 30 | - | - | 28 | - | 26 | - | 25 | 25 | - | 23 | 22 | 21 |
| Utilitas CPU per proses D | - | - | - | 40 | - | - | 37 | - | 35 | 33 | - | 32 | 31 | 30 | 28 |

Proses A dan B berjalan sejak $t=0$. Proses C mulai berjalan saat waktu CPU (*CPU time*) proses B mencapai 38 satuan waktu. Proses A berhenti setelah proses C berjalan selama 200 satuan waktu. Proses D hanya dijalankan setelah proses A berhenti. Semua proses yang masih berjalan berhenti pada saat $t=600$.

(a) Lengkapi diagram berikut ini:



- (b) Berapa waktu CPU (*CPU TIME*) proses “A”?
- (c) Berapa waktu CPU (*CPU TIME*) proses “B”?
- (d) Berapa waktu CPU (*CPU TIME*) proses “C”?
- (e) Berapa waktu CPU (*CPU TIME*) proses “D”?
- (f) Berapa waktu total (*TOTAL TIME*) proses “A” berjalan?
- (g) Berapa waktu total (*TOTAL TIME*) proses “B” berjalan?
- (h) Berapa waktu total (*TOTAL TIME*) proses “C” berjalan?
- (i) Berapa waktu total (*TOTAL TIME*) proses “D” berjalan?

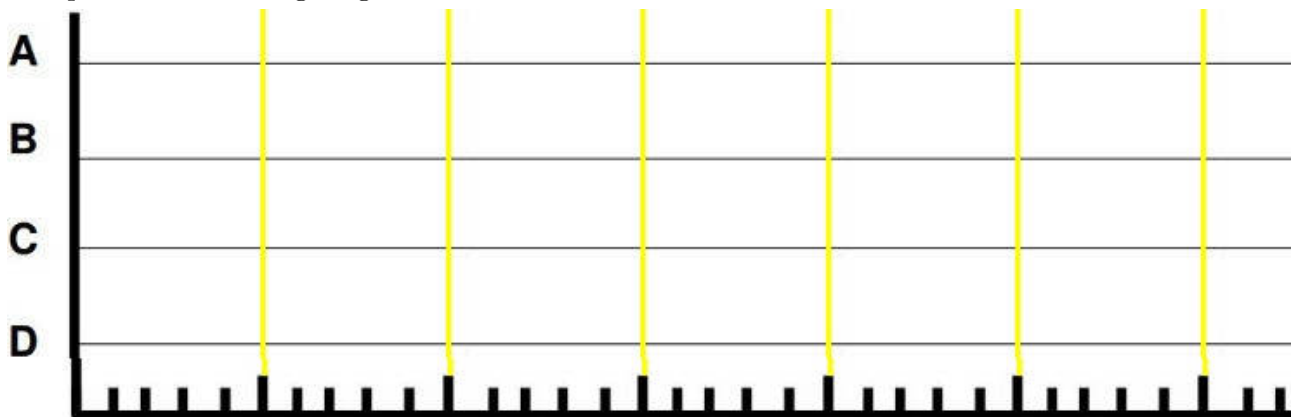
4. 2017-2

Four (4) processes, A(90%, 14), B(80%, 60), C(70%, 64), D(60%, 161); where $[W(X\%, Y)$; W =process name; X = I/O Wait(%); Y =CPU Time] with this following CPU utilization table:

| | Multiprogramming Combination (%) | | | | | | | | | | | | | | |
|---------------------------|----------------------------------|----|----|----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|---------|
| | A | B | C | D | A+B | A+C | A+D | B+C | B+D | C+D | A+B+C | A+B+D | A+C+D | B+C+D | A+B+C+D |
| Process A CPU utilization | 10 | - | - | - | 9.3 | 9.3 | 9.2 | - | - | - | 8.3 | 8.1 | 7.8 | - | 7 |
| Process B CPU utilization | - | 20 | - | - | 19 | - | - | 18 | 17 | - | 17 | 16 | - | 15 | 14 |
| Process C CPU utilization | - | - | 30 | - | - | 28 | - | 26 | - | 25 | 25 | - | 23 | 22 | 21 |
| Process D CPU utilization | - | - | - | 40 | - | - | 37 | - | 35 | 33 | - | 32 | 31 | 30 | 28 |

All processes (A, B, C, and D) terminates at $t=500$. Process D starts at $t=0$. Processes A, B, and C start after process D.

(a) Complete this following diagram:



- (b) Calculate at what time processes A, B, and C start!
- (c) How long will be the TOTAL TIME of process D, if the process (D) runs alone?

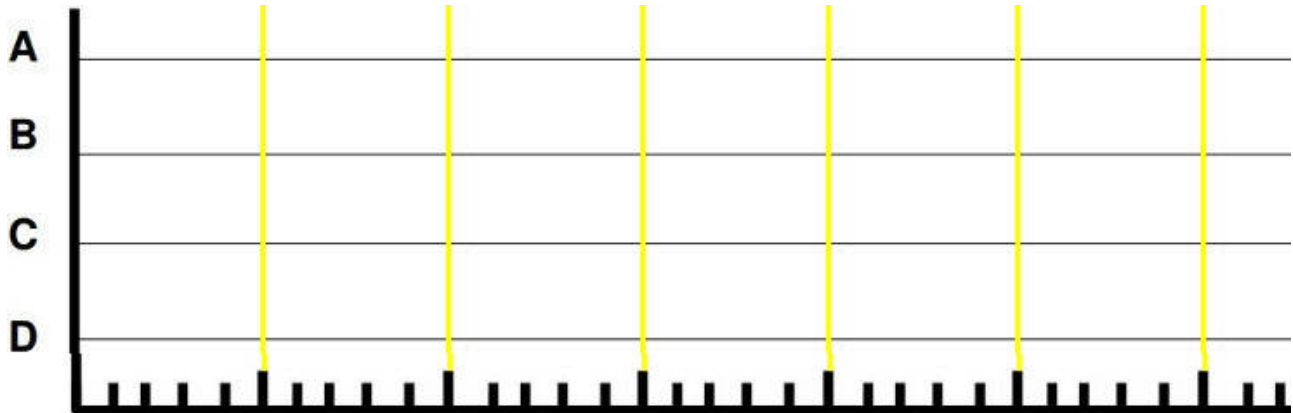
5. 2018-1

Four (4) processes, A(46.8), B(17.0), C(53.0), D(37.0); where [X(Y); X = process name; Y = CPU Time] with this following CPU utilization table:

| | Multiprogramming Combination (%) | | | | | | | | | | | | | | |
|---------------------------|----------------------------------|----|----|----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|---------|
| | A | B | C | D | A+B | A+C | A+D | B+C | B+D | C+D | A+B+C | A+B+D | A+C+D | B+C+D | A+B+C+D |
| Process A CPU utilization | 10 | - | - | - | 9.3 | 9.3 | 9.2 | - | - | - | 8.3 | 8.1 | 7.8 | - | 7 |
| Process B CPU utilization | - | 20 | - | - | 19 | - | - | 18 | 17 | - | 17 | 16 | - | 15 | 14 |
| Process C CPU utilization | - | - | 30 | - | - | 28 | - | 26 | - | 25 | 25 | - | 23 | 22 | 21 |
| Process D CPU utilization | - | - | - | 40 | - | - | 37 | - | 35 | 33 | - | 32 | 31 | 30 | 28 |

Processes A, B, and C start at t=0, and process D starts at t=300.

(a) Complete this following diagram, including the time of the X-axis!



(b) What is the TOTAL TIME of process A?

(c) What is the TOTAL TIME of process B, if the process runs alone?

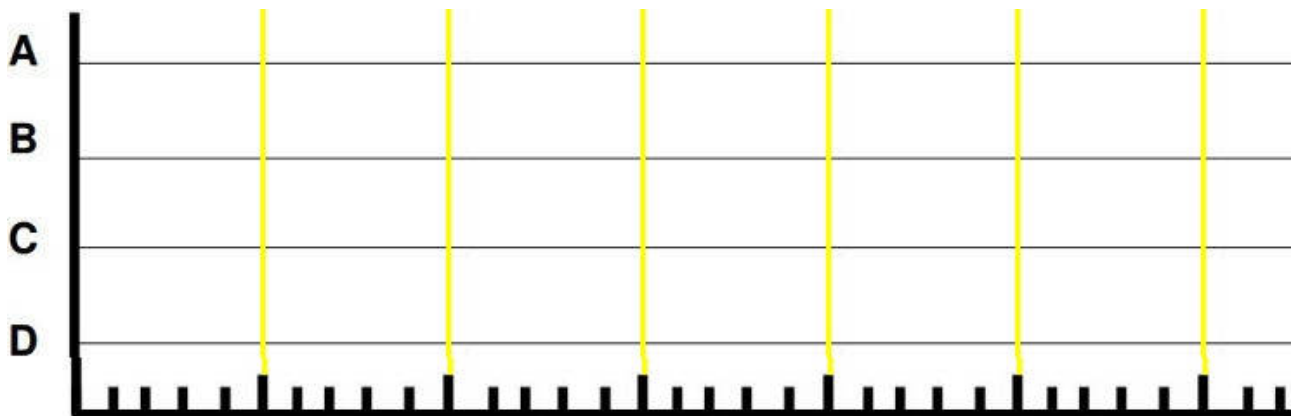
6. 2018-2

Four (4) processes, A(460), B(540), C(280), D(320); where [X(Y); X = process name; Y = CPU Time] with this following CPU utilization table:

| | Multiprogramming Combination (%) | | | | | | | | | | | | | | |
|---------------------------|----------------------------------|----|----|----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|---------|
| | A | B | C | D | A+B | A+C | A+D | B+C | B+D | C+D | A+B+C | A+B+D | A+C+D | B+C+D | A+B+C+D |
| Process A CPU utilization | 10 | - | - | - | 9.3 | 9.3 | 9.2 | - | - | - | 8.3 | 8.1 | 7.8 | - | 7 |
| Process B CPU utilization | - | 20 | - | - | 19 | - | - | 18 | 17 | - | 17 | 16 | - | 15 | 14 |
| Process C CPU utilization | - | - | 30 | - | - | 28 | - | 26 | - | 25 | 25 | - | 23 | 22 | 21 |
| Process D CPU utilization | - | - | - | 40 | - | - | 37 | - | 35 | 33 | - | 32 | 31 | 30 | 28 |

Processes A, B, and D start at t=0, and process C starts at t=3000.

(a) Complete this following diagram, including the time of the X-axis!



(b) What is the TOTAL TIME of process A?

(c) What is the TOTAL TIME of process D, if the process runs alone?

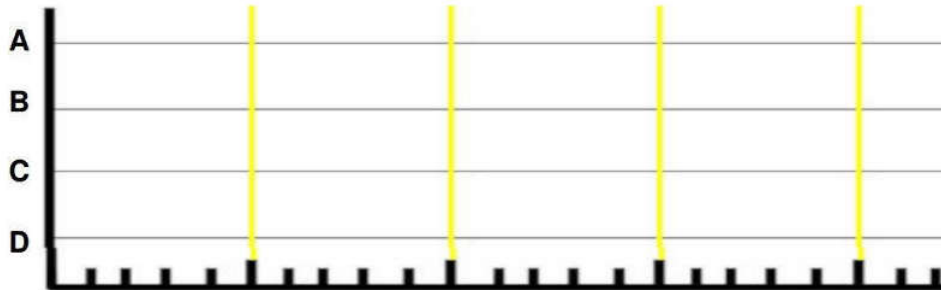
7. 2019-1 (82.8%)

Four (4) processes, A(286), B(360), C(280), D(350); where [X(Y); X = process name; Y = CPU Time] with this following CPU utilization table:

| | Multiprogramming Combination (%) | | | | | | | | | | | | | | |
|---------------------------|----------------------------------|----|----|----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|---------|
| | A | B | C | D | A+B | A+C | A+D | B+C | B+D | C+D | A+B+C | A+B+D | A+C+D | B+C+D | A+B+C+D |
| Process A CPU utilization | 10 | - | - | - | 9.3 | 9.3 | 9.2 | - | - | - | 8.3 | 8.1 | 7.8 | - | 7 |
| Process B CPU utilization | - | 20 | - | - | 19 | - | - | 18 | 17 | - | 17 | 16 | - | 15 | 14 |
| Process C CPU utilization | - | - | 30 | - | - | 28 | - | 26 | - | 25 | 25 | - | 23 | 22 | 21 |
| Process D CPU utilization | - | - | - | 40 | - | - | 37 | - | 35 | 33 | - | 32 | 31 | 30 | 28 |

Processes A and C: **start** at t=0; **end** before t=4000. Processes B and D: **start** after t=0; **end** at t=4000.

(a) (84%) Complete this following diagram, including the time of the X-axis!



- (b) (83%) What is the TOTAL TIME of process A? _____
- (c) (83%) What is the TOTAL TIME of process B? _____
- (d) (87%) What is the TOTAL TIME of process C? _____
- (e) (86%) What is the TOTAL TIME of process D? _____

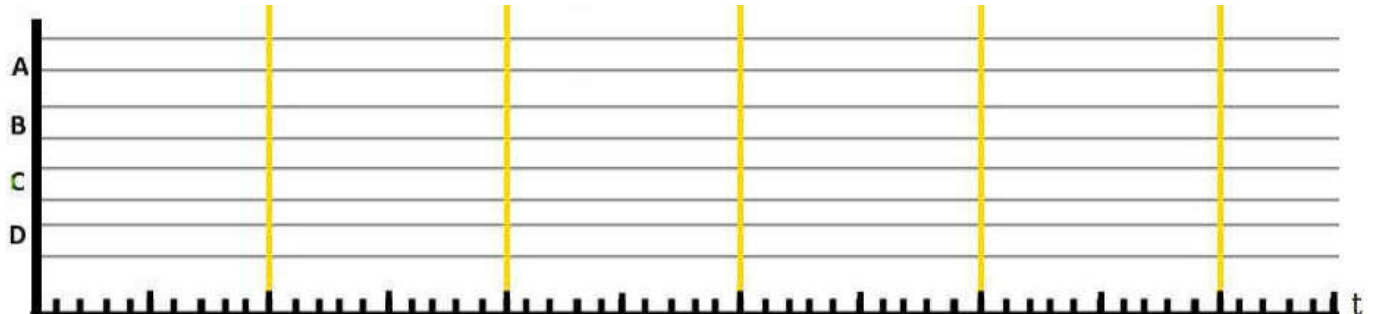
8. 2019-2 (76.0%)

Four (4) processes, A(314), B(830), C(420), D(880); where [X(Y); X = process name; Y = CPU Time] with this following CPU utilization table:

| | Multiprogramming Combination (%) | | | | | | | | | | | | | | |
|---------------------------|----------------------------------|----|----|----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|---------|
| | A | B | C | D | A+B | A+C | A+D | B+C | B+D | C+D | A+B+C | A+B+D | A+C+D | B+C+D | A+B+C+D |
| Process A CPU utilization | 10 | - | - | - | 9.3 | 9.3 | 9.2 | - | - | - | 8.3 | 8.1 | 7.8 | - | 7 |
| Process B CPU utilization | - | 20 | - | - | 19 | - | - | 18 | 17 | - | 17 | 16 | - | 15 | 14 |
| Process C CPU utilization | - | - | 30 | - | - | 28 | - | 26 | - | 25 | 25 | - | 23 | 22 | 21 |
| Process D CPU utilization | - | - | - | 40 | - | - | 37 | - | 35 | 33 | - | 32 | 31 | 30 | 28 |

All processes **end** at t=5000.

(a) Complete this following diagram, including the time of the X-axis (72%)!



- (b) What is the TOTAL TIME of process A (81%)? _____
- (c) What is the TOTAL TIME of process B (79%)? _____
- (d) What is the TOTAL TIME of process C (83%)? _____
- (e) What is the TOTAL TIME of process D (80%)? _____