

Real Time Systems Lab 1

1.

$$\begin{aligned} \text{a. } v &= \frac{s}{t} \rightarrow t = \frac{s}{v} & v \left[\frac{km}{h} \right] * f &= v \left[\frac{m}{s} \right] & 3.6 \frac{km}{h} &= \frac{3600m}{3600s} = 1 \frac{m}{s} & 1 \frac{km}{h} &= \frac{1000m}{3600s} \\ f &= \frac{10h*m}{36km*s} \rightarrow v \left[\frac{km}{h} \right] * \frac{10h*m}{36km*s} &= v \left[\frac{m}{s} \right] & t &= \frac{1m}{v*f} \end{aligned}$$

30 km/h	50 km/h	100 km/h	200 km/h
8.31 m/s	13.85 m/s	27.7 m/s	55.4 m/s
0.12 s/m	0.0722 s/m	0.036 s/m	0.018 s/m

b. Mach 3 = 3704.4 km/h = 1029 m/s = 1.029 m/ms → 1s = 1000 ms

c. $c_{vak} = 3 * 10^8 m/s$ $1s = 1000ms = 1000000000ns = 1 * 10^{-9}s$
 $\frac{3*10^8 m/s}{10^{-9}s} = 0.3m/ns$

d. electric signal $\approx \frac{c}{2} = 150000000 \frac{m}{s} = 15 * 10^7 m/s$ Way = 30cm
 $15 * 10^7 \frac{m}{s} = 15 * 10^9 \frac{cm}{s} \rightarrow 30cm \text{ in } 0.000000002s = 2ns = 500MHz$
 $f = \frac{1}{\tau} Hz = \frac{1}{s}$

e. 3.1KHz bandwidth → Nyquist Shannon → 6.2KHz

$$16MHz = 16000KHz \frac{16000KHz}{6.2 KHz} = 2580.645 \text{ clock cycles for one sampling}$$

2.

Process	Period T	Computation Time C
A	25	10
B	25	8
C	50	5
D	50	4
E	100	2

Minor Cycle = greatest common divisor = 25

Major Cycle = least common multiplier = 100

Loop

Wait for interrupt (0);

Call (A);

Call (B);

Call (C);

Wait for interrupt (25);

Call (A);

Call (B);

Call (D);

Call (E);

Wait for interrupt (50);

Call (A);

Call (B);

Call (C);

End loop

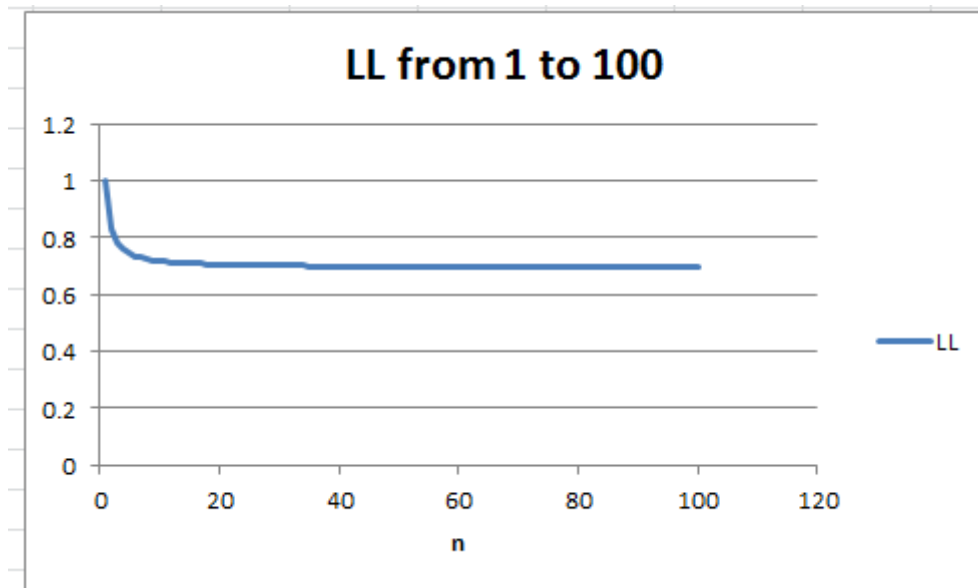
Wait for interrupt (75);

Call (A);

Call (B);

Call (D);

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Exercise 3, 4 and 5 output:

```
Enter Filename: RTS1.txt
Input :
A      50      12
B      40      10
C      30      10

Priority Table:
Name   Period  CompTime   Priority
C      30      10         3
B      40      10         2
A      50      12         1

Utilization: 0.823333
isLLScheduable: 0.823333 <= 0.779763 -> 0
major Cycle: 600
minor Cycle: 30

Schedule :
Error at Process A: not scheduable, current schedule: !0! CCCCCCCCCBBBBBBBBBAAAAAAAAAAAA !30! CCCCCCCCCBBBBBBBBBBA
Enter Filename: RTS2.txt
Input :
A      80      40
B      40      10
C      20      5

Priority Table:
Name   Period  CompTime   Priority
C      20      5         3
B      40      10         2
A      80      40         1

Utilization: 1
isLLScheduable: 1 <= 0.779763 -> 0
major Cycle: 80
minor Cycle: 20

Schedule :
!0! CCCCCBBBBBBBBBAAAAAAAA !20! CCCCCAAAAAAAAAAAAAAAAA !40! CCCCCBBBBBBBBBAAAAAAAA !60! CCCCCAAAAAAAAAAAAAAAAA !80!
```

Conclusion from 4 and 5:

The utilization in both cases is high enough to fail the schedulability-test. The first task cannot be scheduled in RMS because the priority never changes. The utilization in task 2 is 100%, which is higher than the other task, but it is still scheduable in RMS. The utilization might give an indication about scheduability, but it is not the only factor.