Ques 1

Part a

A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	D	E	A	B	D	E	A	B	D	E	A	B	E	A	B	E	A	B	E	A	E	A	E	A	E	A	A

0   45

Each box represents 1 time quantum of 1 min.

Process	Turn around time	Average turn around time
A	45	(45 + 35 + 13 + 26 + 42) / 5 = 32.2
B	35	
C	13	
D	26	
E	42	

Part b

B	E	A	C	D
0 9	21	36	39	45

Process	Turn around time	Average turn around time
A	36	(36 + 9 + 39 + 45 + 21) / 5 = 30
B	9	
C	39	
D	45	
E	21	

Part c

A	B	C	D	E
0	15	24	27	33 45

Process	Turn around time	Average turn around time
A	15	(15 + 24 + 27 + 33 + 45) / 5 = 28.8
B	24	
C	27	
D	33	
E	45	

Part d

C	D	B	E	A

0	3	9	18	30	45

Process	Turn around time	Average turn around time
A	45	(45 + 18 + 3 + 9 + 30) / 5 = 21
B	18	
C	3	
D	9	
E	30	

Ques 2

Part a

A	B	C	A	B	C	A	B	A	B	B	B
0	40	80	120	150	180	200	220	240	250	260	270 280

Process	Waiting time	Average Waiting time
A	0+20+70+20 = 210	(210+160+140) / 3 = 170
B	40+70+40+10 = 160	
C	80+60 = 140	

Ques 3

Case 1: X < 3

Then the sequence would look like (X, 3, 5, 6, 9).

Case 2: 3 < X < 5

Then the sequence would look like (3, X, 5, 6, 9).

Case 3: 5 < X < 6

Then the sequence would look like (3, 5, X, 6, 9).

Case 4: 6 < X < 9

Then the sequence would look like (3, 5, 6, X, 9).

Case 5: 9 < X

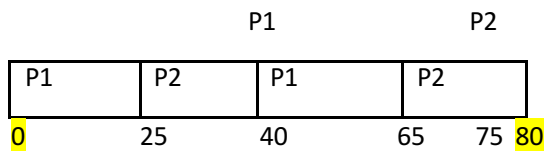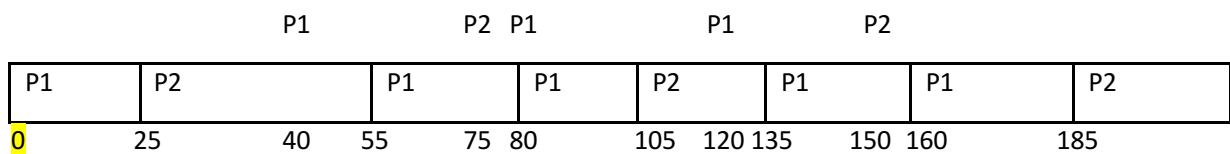Then the sequence would look like (3, 5, 6, 9, X).

Ques 4

Part a

Process	Running Time	Period	CPU Utilization	Total Utilization
P1	25	40	25/40 = 0.625	0.625 + 0.4 = 1.025
P2	30	75	30 / 75 = 0.4	

Since the utilization of CPU is greater than 1, it is not possible to use RMS.

```
                 P1                P2
┌────────┬────────┬────────┬────────┐
│  P1    │  P2    │  P1    │  P2    │
└────────┴────────┴────────┴────────┘
0        25       40       65   75  80
```

Hence RMS is not possible.

Part b

```
              P1              P2  P1             P1           P2
┌────────┬────────┬─────┬──────┬──────┬──────┬──────┬──────┬──────┐
│  P1    │  P2    │ P1  │  P1  │  P2  │  P1  │  P1  │      │  P2  │
└────────┴────────┴─────┴──────┴──────┴──────┴──────┴──────┴──────┘
0        25       40    55    75  80  105   120 135  150 160  185
```

This is how we can use EDF to schedule the processes.

Ques 5

Process	Processing Time	Period	CPU Utilization	Total Utilization
P1	20	90	20/90 = 0.22	(0.22 + 0.12 + 0.189 + 0.15 + 0.0625) = 0.7415
P2	30	250	30/250 = 0.12	
P3	70	370	70/370 = 0.189	
P4	50	330	50/330 = 0.15	
P5	125	2000	125/2000 = 0.0625	

According to the formula the worst-case CPU Utilization for RMS = $5 * (2^{1/5} - 1) = 0.7434$

Since worst case time is greater than the actual utilization hence the RMS scheduling can be used.