1.

1. $\lambda \frac{\text{packets}}{s}$ Interarrival time = At (exponential) Service rate = $\mu \frac{\text{packets}}{s}$

stability: buffer doesn't overflow rate = St

(a) $\frac{\lambda}{\mu} < 1$

(b) $\frac{St}{At} < 1$

2.

2. $\lambda = 48 \frac{\text{packets}}{s}$ → FIFO storing $125 \times 10^{-6}\,s$ to serve a byte

average packet len = 125 Bytes

(a) Yes: $\overline{\text{rate}} = \mu = \frac{1 \text{ byte}}{125 \times 10^{-6}\,s} \cdot \frac{1 \text{ packet}}{125 \text{ bytes}} = \boxed{64 \frac{\text{packets}}{s}}$ (avg)

(b) $D = \frac{1}{\mu - \lambda} = \frac{1}{64 \frac{\text{packets}}{s} - 48 \frac{\text{packets}}{s}} = \boxed{.0625\ s}$

(c) $W = D - \frac{1}{\mu} = .0625 - \frac{1}{64} = \boxed{.046875\ s}$

(d) $N_q = D \cdot \lambda = (.0625\ s)(48 \frac{\text{packets}}{s}) = \boxed{3 \text{ packets}}$

3.

3. 24 users, each at $\overline{48} \frac{\text{packets}}{s}$ $\mu = 64 \frac{\text{packets}}{s}$

$\lambda = 24 \cdot 48 \frac{\text{packets}}{s}$

$D = \frac{1}{\mu - \lambda} = \frac{1}{(64 - 48)} = \boxed{.0625\ s}$

4. (a)

4. (a) $\lambda = 1$ 10000 customers

$\mu = 1.5$

$$\frac{1}{(\mu - \lambda)} - \frac{1}{\mu}$$

$$\frac{1}{0.5} - \frac{1}{1.5}$$

$$2 - 0.67$$

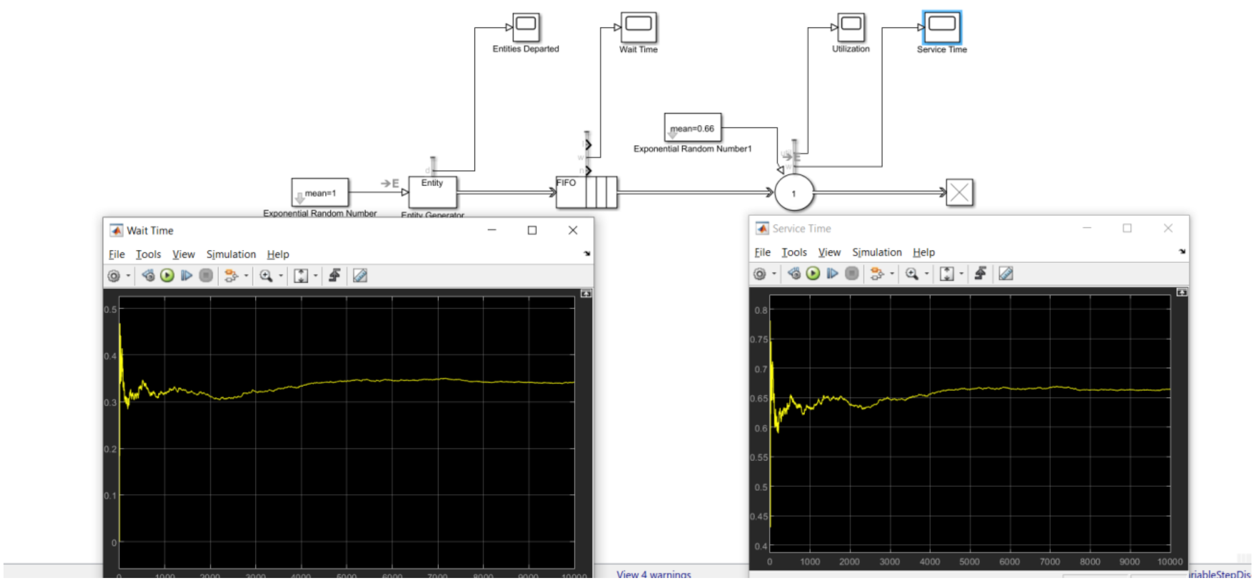
$= 1.33$ s wait time

$$D = \frac{1}{(1.5 - 1)} = 2.5$$

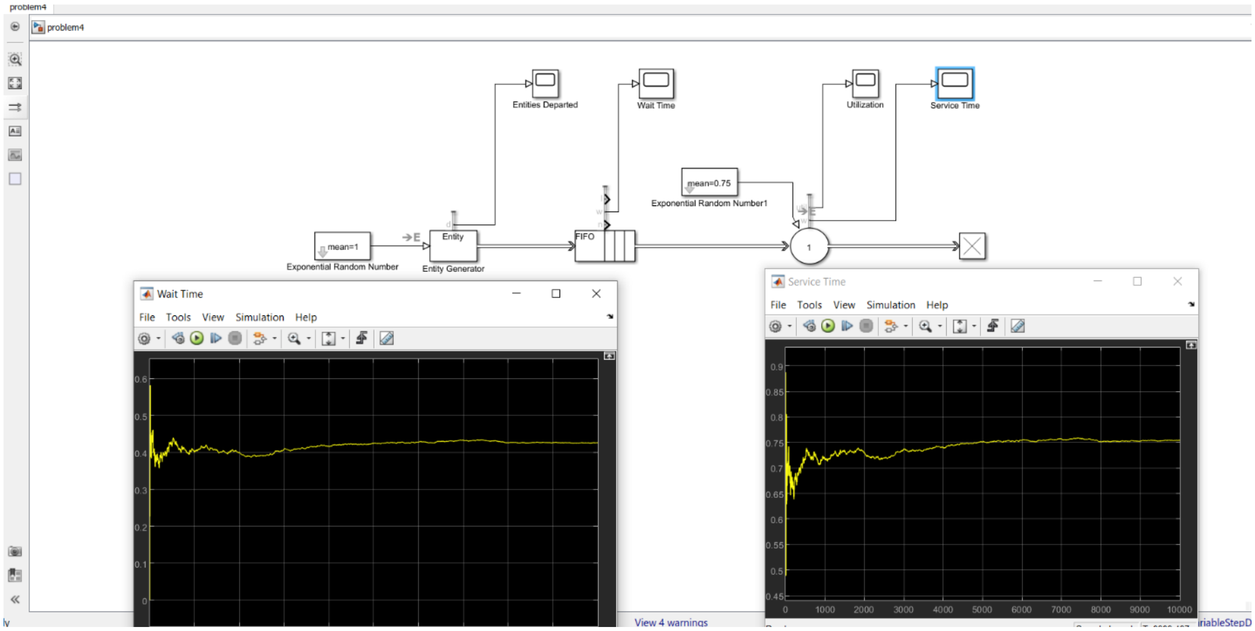
$$\text{Wait time} = \frac{2.5}{1.5} = 1.33 \text{ s}$$

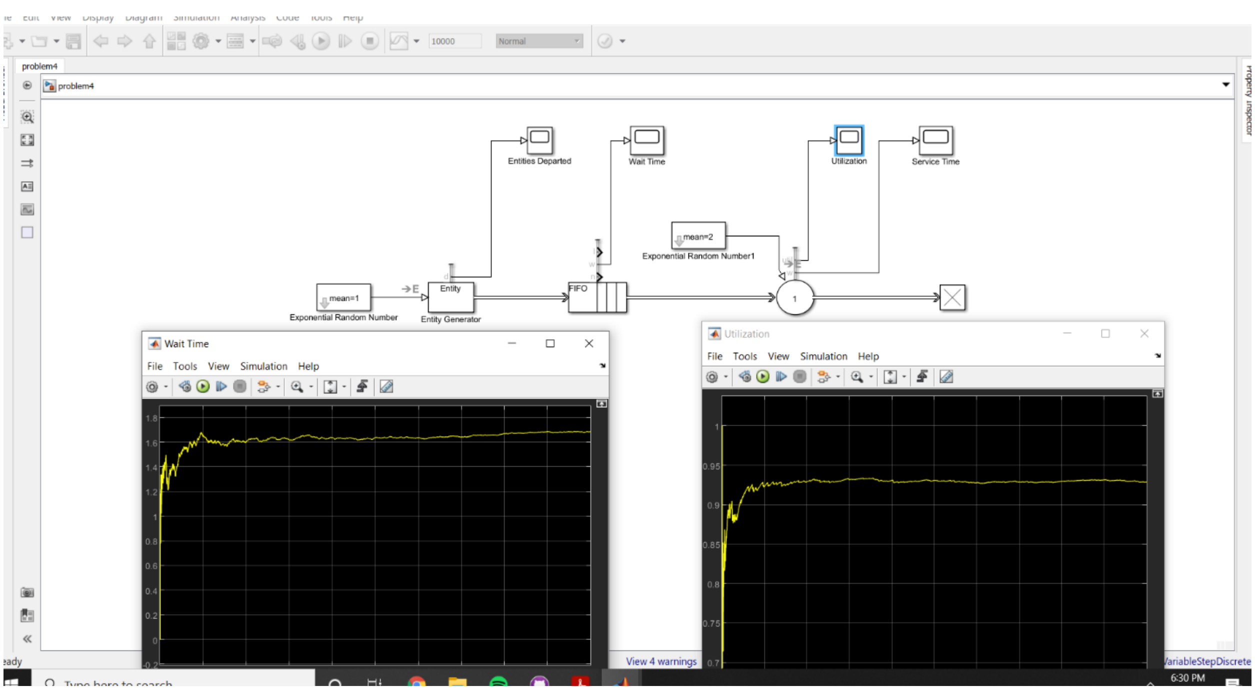
Service time $= D - W = 0.67$ s

(b)

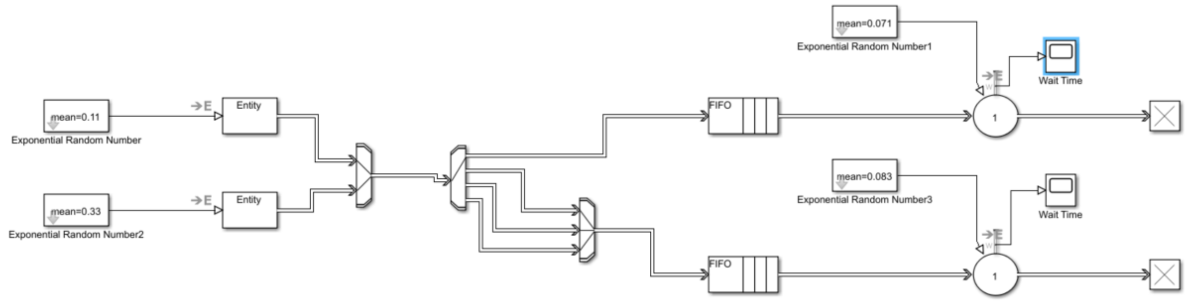


(c)

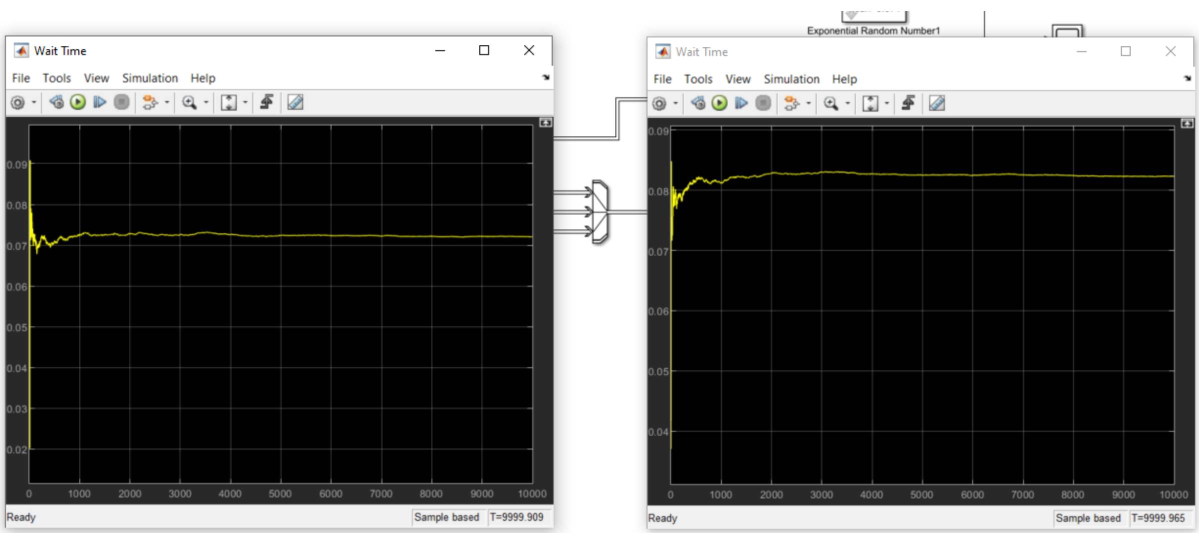

problem4
Entities Departed
Wait Time
Utilization
Service Time
mean=0.75
Exponential Random Number1
mean=1
Exponential Random Number
Entity Generator
FIFO
View 4 warnings


problem4
Entities Departed
Wait Time
Utilization
Service Time
mean=2
Exponential Random Number1
mean=1
Exponential Random Number
Entity Generator
FIFO
View 4 warnings

5.



mean=0.11
Exponential Random Number
mean=0.33
Exponential Random Number2
Entity
Entity
FIFO
FIFO
mean=0.071
Exponential Random Number1
mean=0.083
Exponential Random Number3
Wait Time
Wait Time
1
1



Exponential Random Number1
Wait Time
File Tools View Simulation Help
Ready
Sample based
T=9999.909
Wait Time
File Tools View Simulation Help
Ready
Sample based
T=9999.965