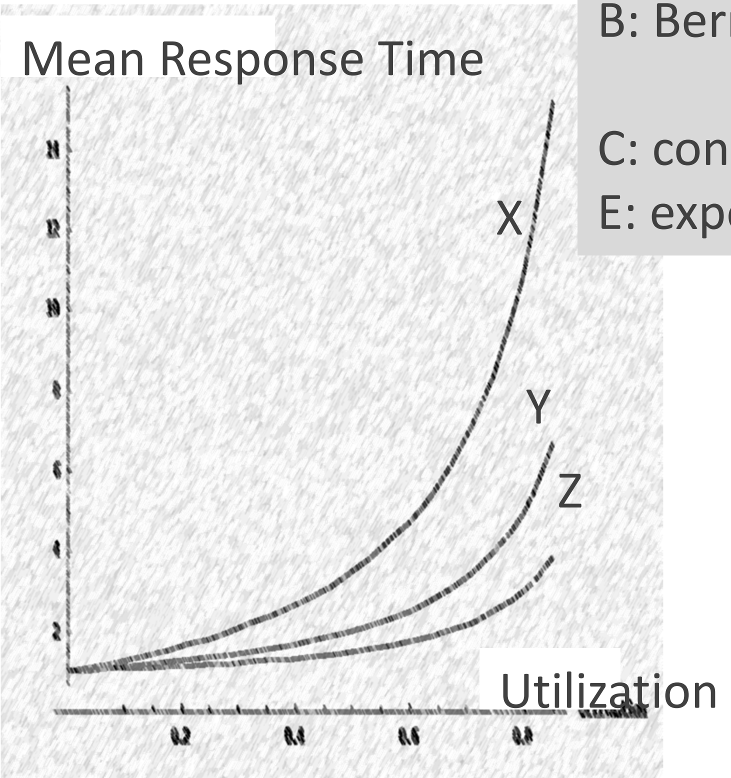
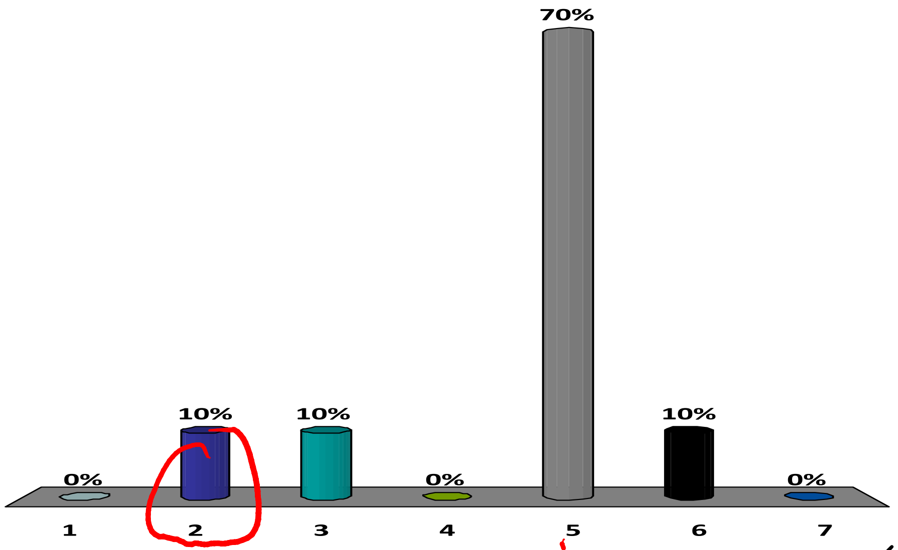
The 3 curves are for an M/GI/1 queue with different distributions of service times. Say which curve is for which distribution.



B: Bernoulli with mean $p = 0.2$
C: constant
E: exponential

1. X=B, Y=C; Z=E
2. X=B, Y=E; Z=C
3. X=E, Y=C; Z=B
4. X=C, Y=B; Z=E
5. X=E, Y=B; Z=C
6. X=C, Y=E; Z=B
7. I don't know



Solution

The curves are ranked by the CoV of the distributions.
Exponential: CoV = 1

Constant: CoV =0

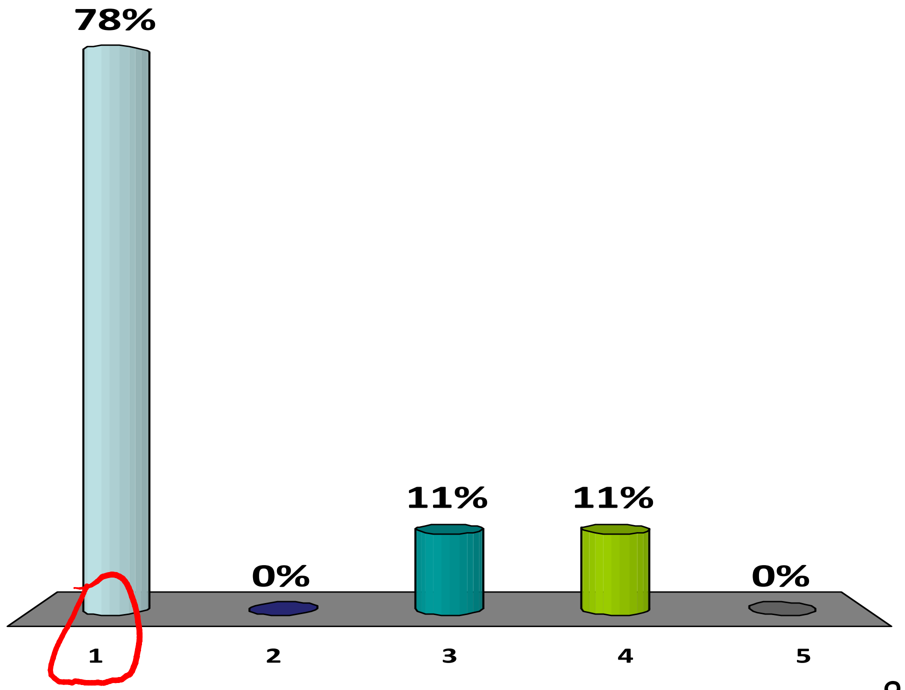
Bernoulli:
mean = 0.2
variance = $p(1-p) = 0.2 \times 0.8 = 0.16$
standard deviation = 0.4
CoV = $\frac{0.4}{0.2} = 2$

Which sentences are true ?
$\lambda =$ arrival rate
$S =$ mean service time

A. For a single server queue, if $\lambda < \frac{1}{S}$ the queue has a stationary regime

B. For an M/GI/1 queue, if $\lambda < \frac{1}{S}$ the queue has a stationary regime

1. Both
2. A
3. B
4. None
5. I don't know



Which sentences are true ?

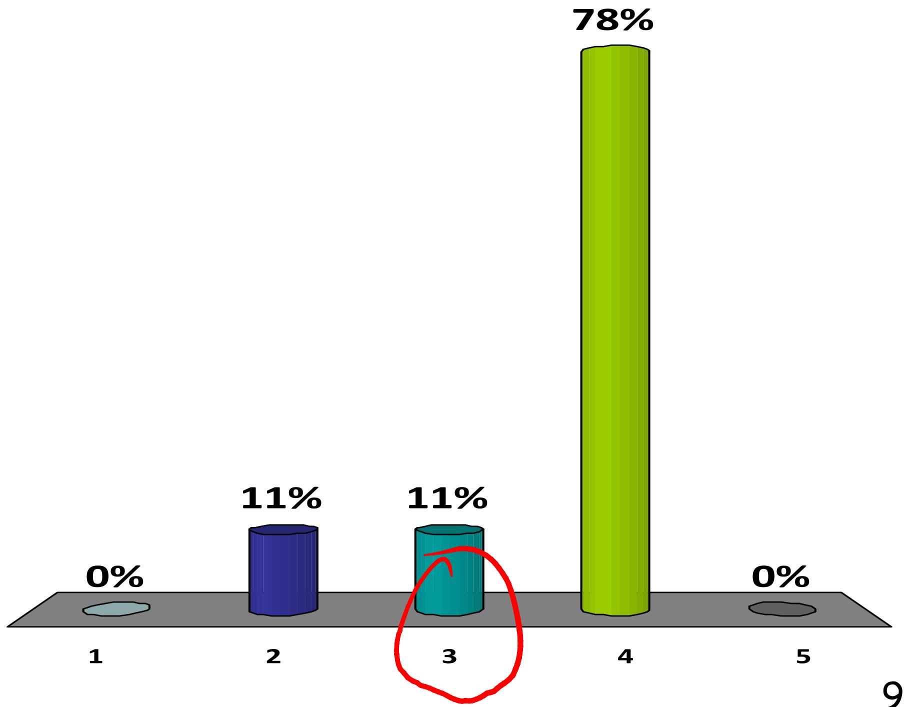
$\lambda =$ arrival rate

$S =$ mean service time

A. For a single server queue, if $\lambda = \frac{1}{S}$ the queue does not have a stationary regime

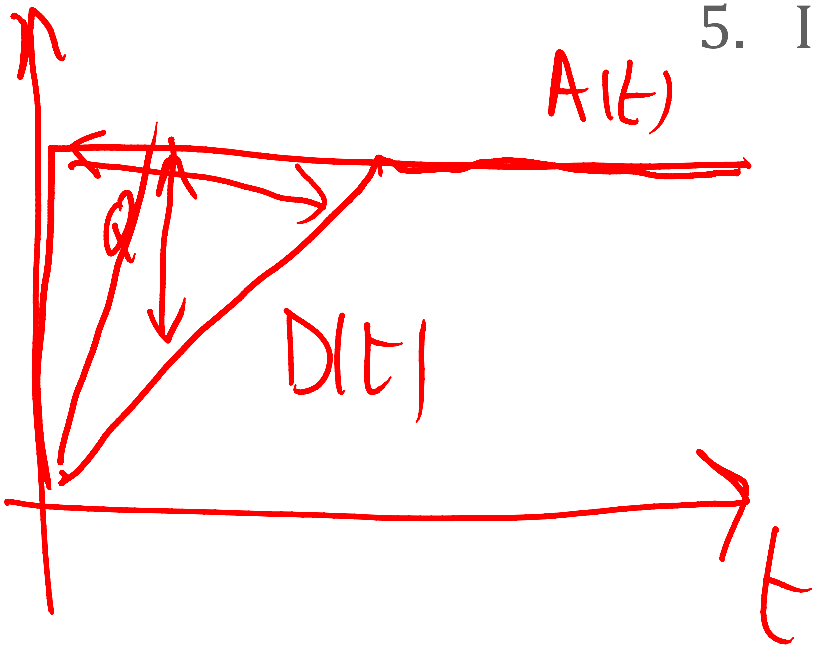
B. For an M/GI/1 queue, if $\lambda = \frac{1}{S}$ the queue does not have a stationary regime

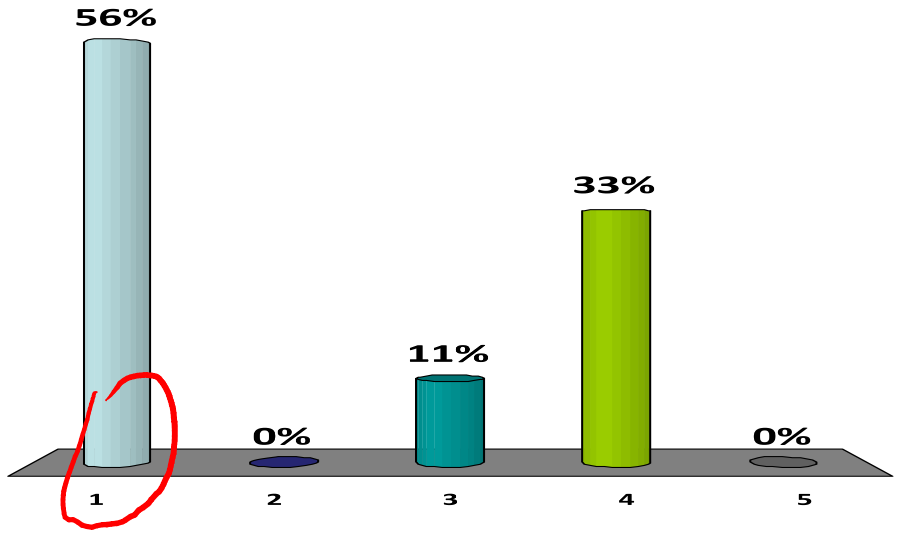
1. Both
2. A
3. B
4. None
5. I don't know



A train with 200 tourists arrive at the skilift. A queue builds up. Doubling the capacity of the skilift would…

1. Reduce the queuing time by a factor of approximately 2
2. Reduce the queuing time by a factor much larger than 2
3. Reduce the queuing time by a factor much smaller than 2
4. It depends on the utilization factor
5. I do not know.



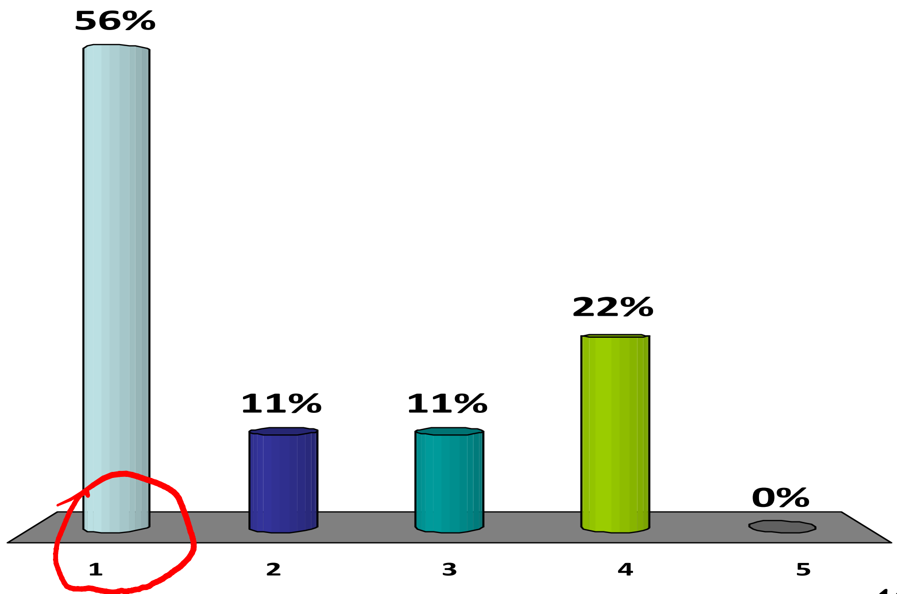


The average number of customers present in an M/GI/∞ queue is …

(S is the mean service time)

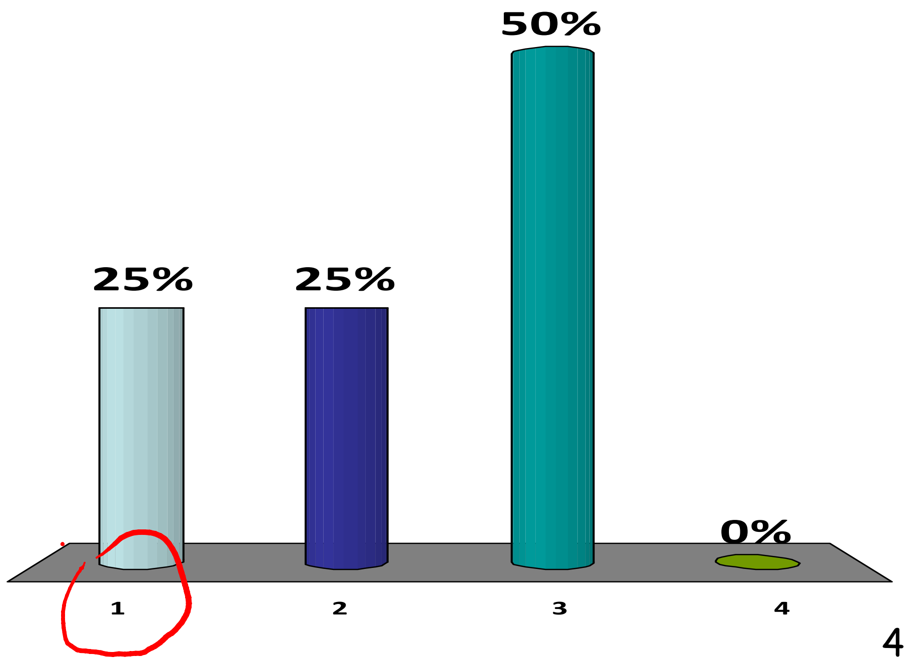
1. $N = \lambda S$
2. $N = \frac{\rho}{1-\rho}$ with $\rho = \lambda S$
3. None of the above, the formula involves the coefficient of variation
4. There is no closed form formula
5. I don't know

Little:



At a FIFO queue, the expected waiting time for a job, given that its service time is s is…

1. Independent of s
2. Proportional to s
3. Dependent on s but not proportional (in general)
4. I don't know.

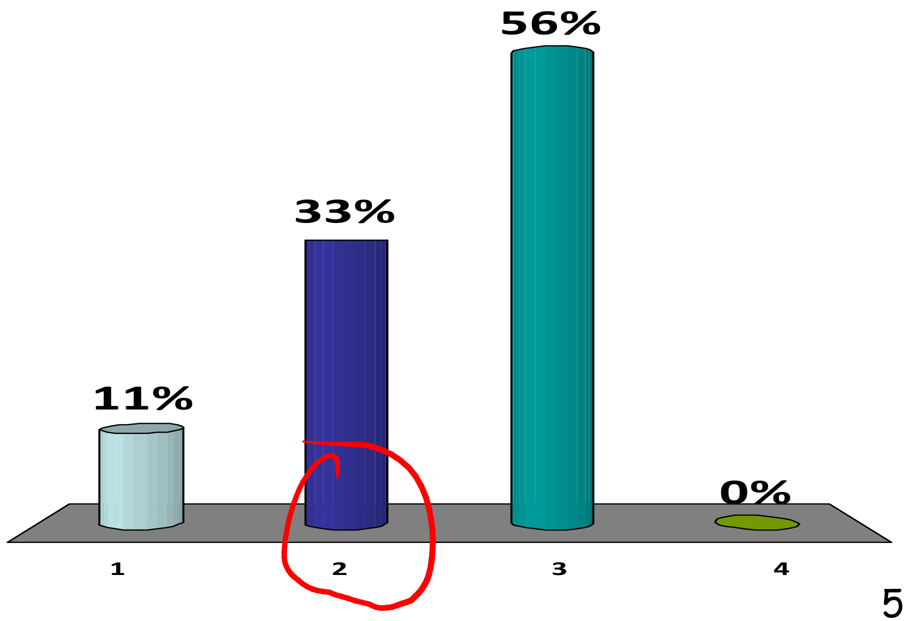


At a PS queue, the expected waiting time for a job, given that its service time is *s* is…

$$E(R \mid S=s) = \frac{s}{1-\rho}$$

$$E(W \mid S=s) = \frac{s}{1-\rho} - s$$

1. Independent of *s*
2. Proportional to *s*
3. Dependent on *s* but not proportional (in general)
4. I don't know.



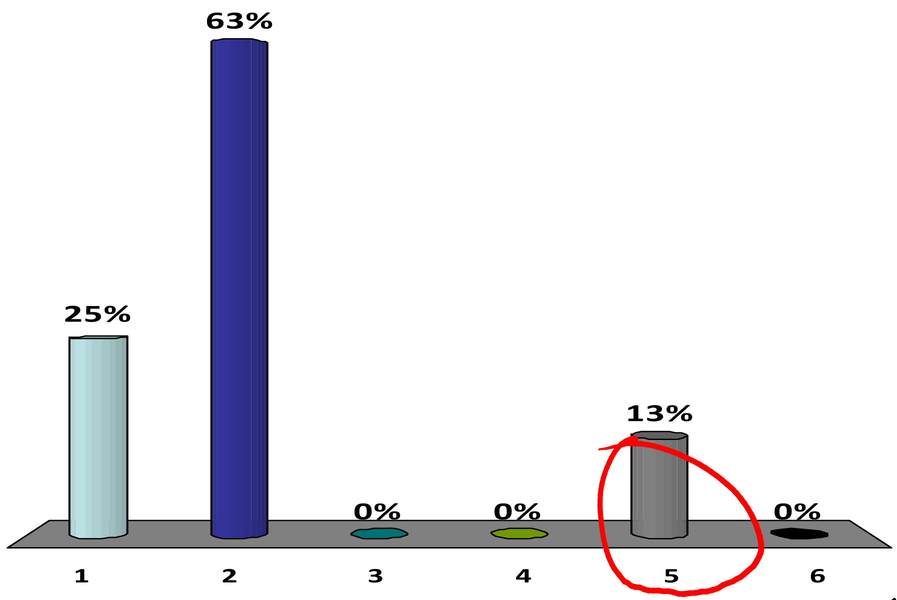
For a M/GI/1 queue, which are equal ?

A = distribution of number of jobs seen by an arriving job

B = distribution of number of jobs left by a departing job

C = distribution of number of jobs seen by an inspector

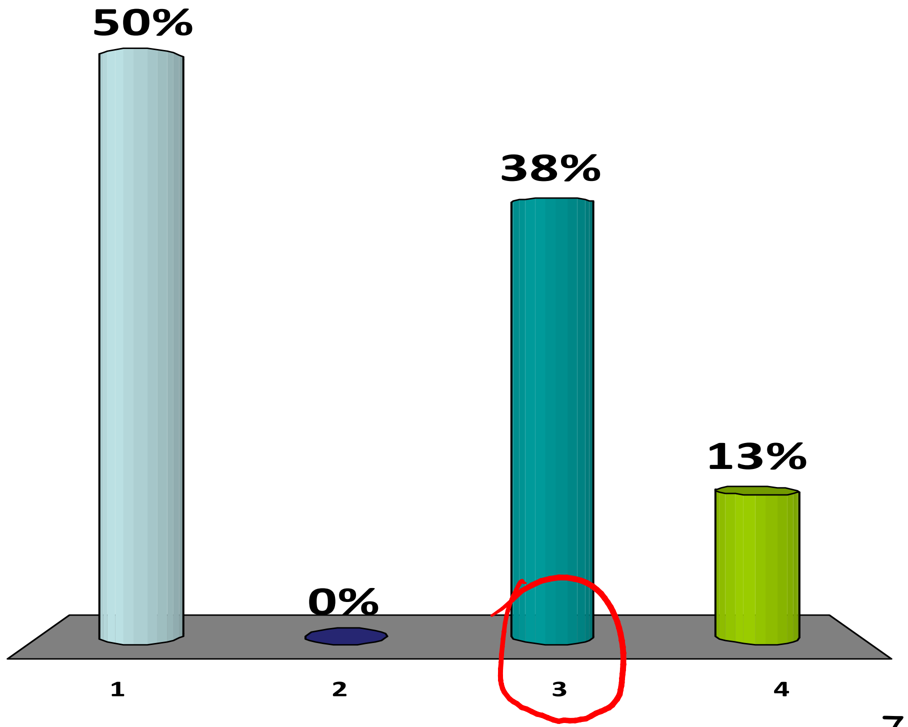
1. None
2. A=B
3. A=C
4. B=C
5. A=B=C
6. I don't know



We have a single class queuing network with FIFO queues, markov routing, Poisson arrivals and iid service times.

Is it a product form queuing network ?

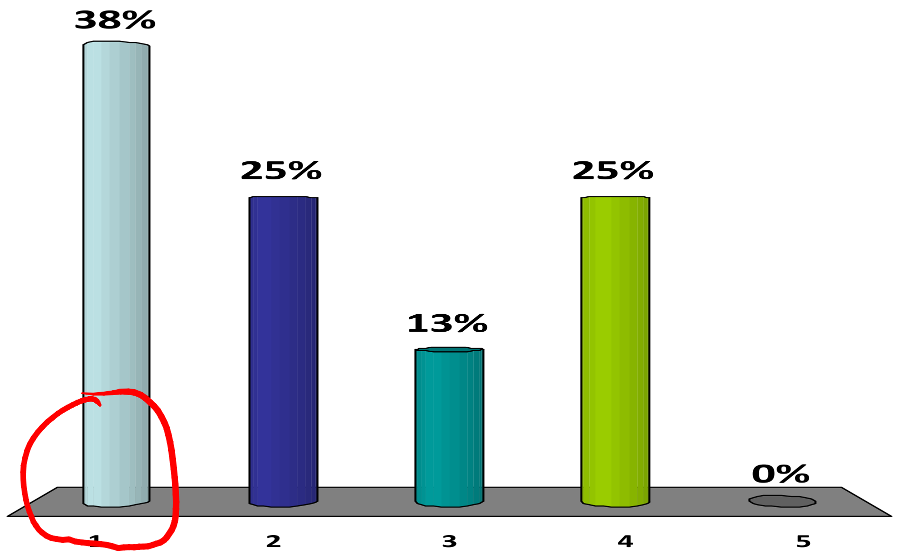
1. Yes.
2. No.
3. It depends on the distribution of the service times.
4. I don't know.



We have a multiclass queuing network with PS queues, markov routing Poisson arrivals and iid service times.

Is it a product form queuing network ?

1. Yes.
2. No.
3. It depends on the distribution of the service times.
4. Yes if the distribution of service times is independent of the class
5. I don’t know.



Arrivals are Poisson, Discipline is FIFO, Services are iid exponential.

Assume

$\boldsymbol{m_1 + m_3 + m_5 = 0.99}$

and

$\boldsymbol{m_2 + m_4 = 0.99}$

1. I can conclude that the network is stable
2. It depends on the values of m_i
3. The network is certainly not stable
4. I don't know

if $m_1 = m_3 = m_5$ and $m_2 = m_4$ → yes

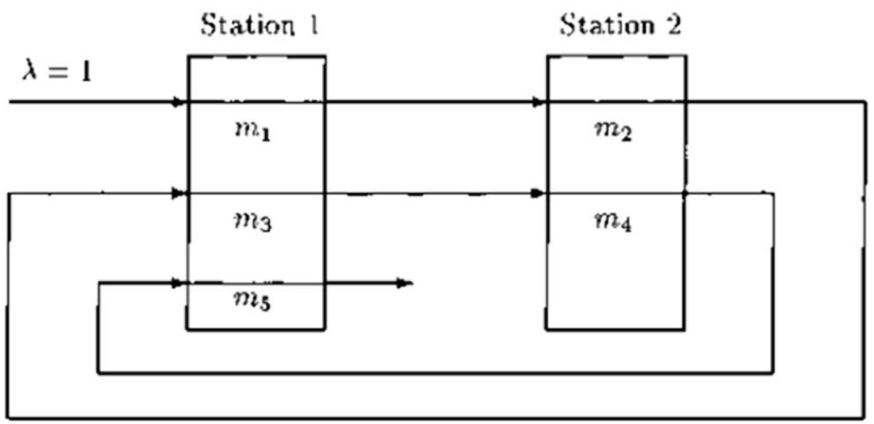
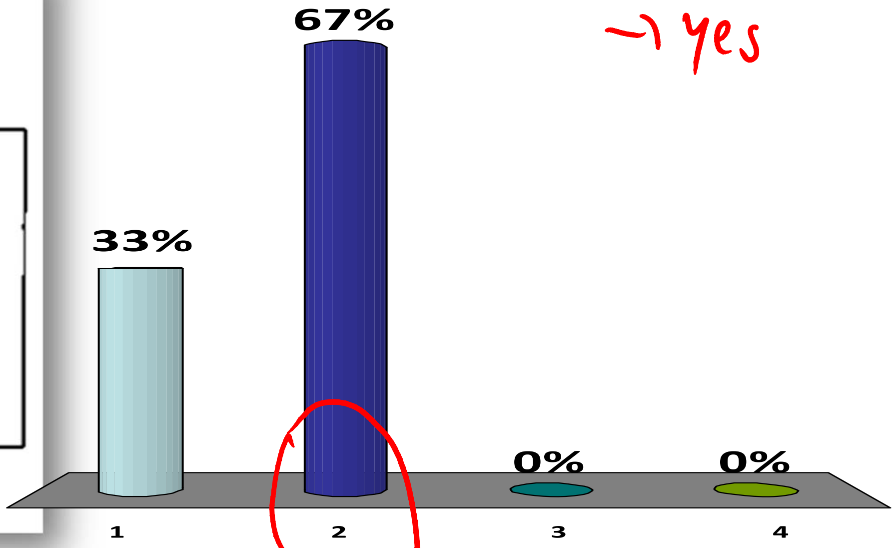
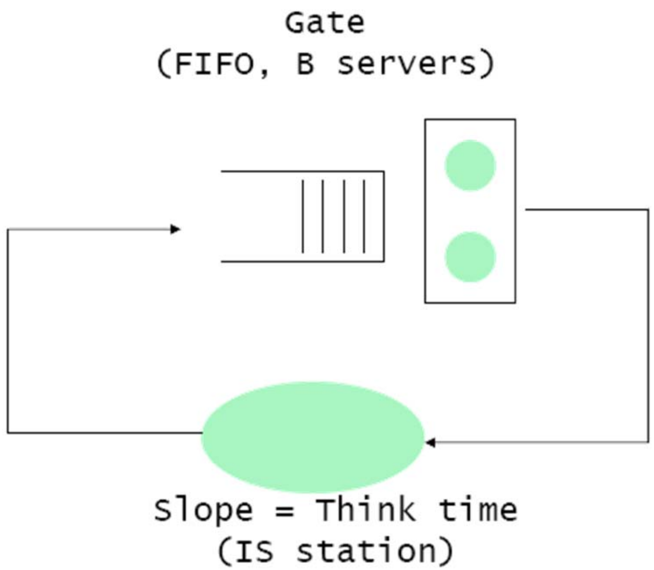


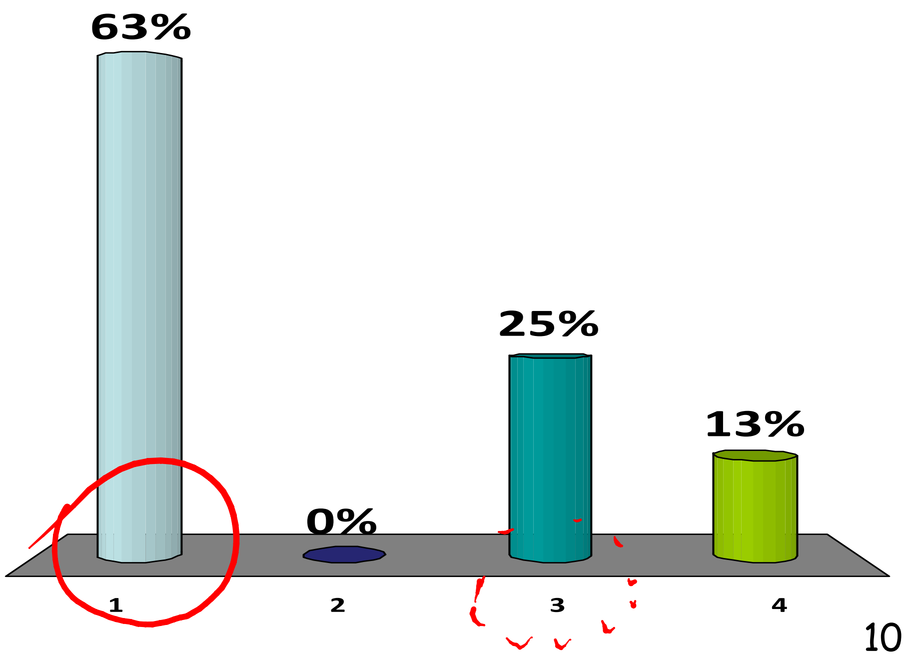
Fig. 1. An example of reentrant lines.



Service at the gate is iid. and exponentially distributed. Is this network stable ?

1. Yes
2. No
3. It depends on the distribution of the service time at the gate
4. I don't know

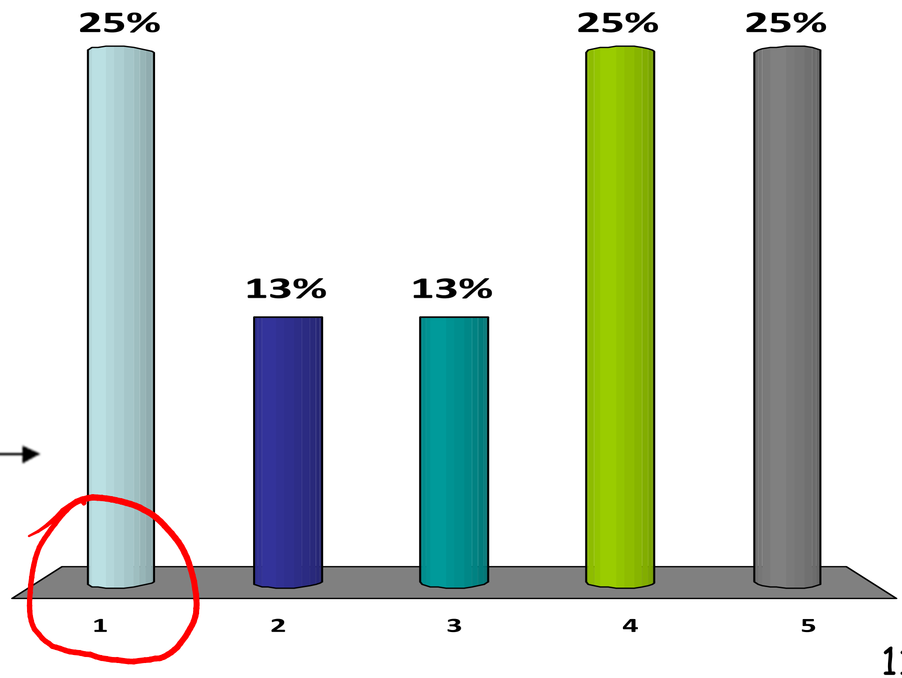


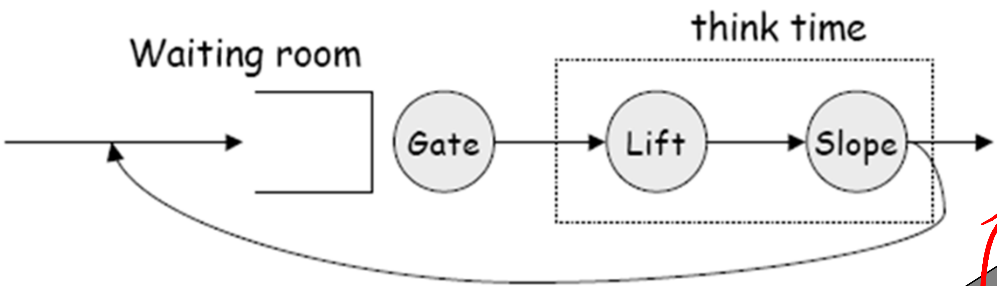


N is the number of skiers present (in average).

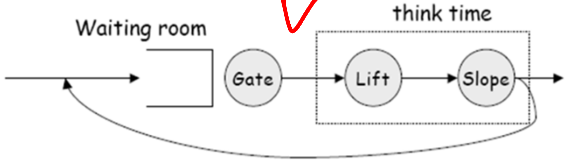
Doubling N would…

1. more than double the waiting time
2. would not significantly impact the waiting time
3. less than double the waiting time
4. none of the above
5. I don't know





Solution



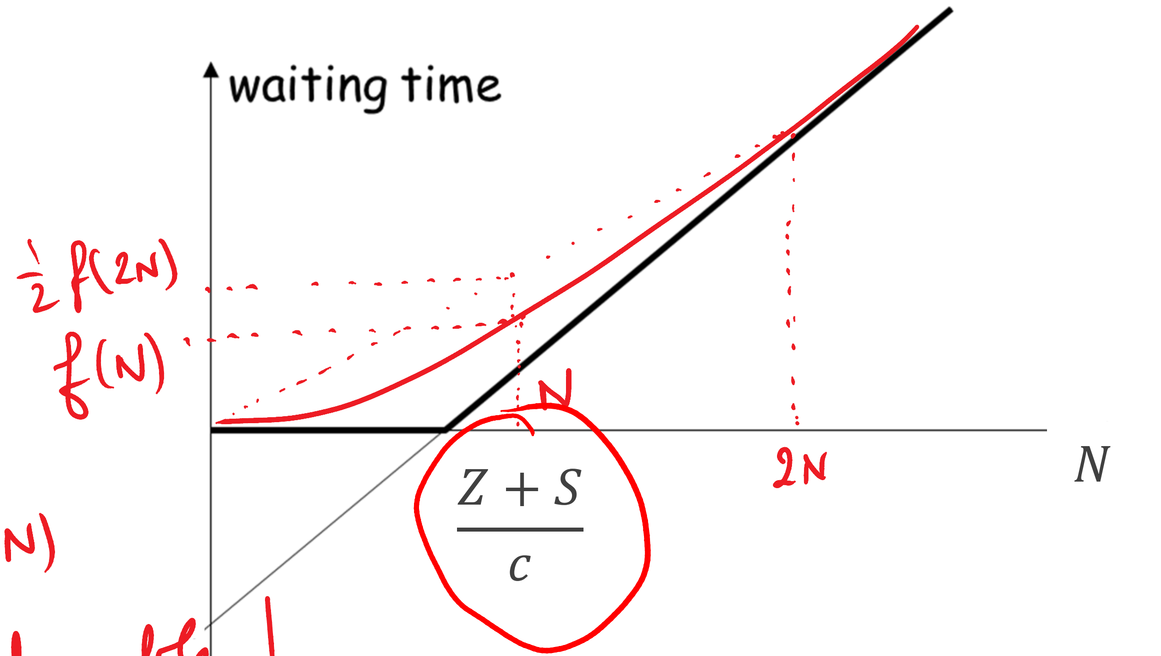
1. $\lambda(W + Z + S) = N$

   $W = \frac{N}{\lambda} - Z - S$

2. Congested system: $\lambda \approx c$

   $$W \approx \frac{N}{c} - Z - S$$

3. Lightly loaded system: $W \approx 0$



$\frac{1}{2} f(2N) > f(N)$

$f(2N) > 2 f(N)$

More than double!