COMP9334
Capacity Planning for Computer Systems and Networks

Week 3A

Note

- Some of these questions can be done by a calculator but some of them require laborious calculations that are best done by a computer software, e.g. Matlab, Octave, Python etc.

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Question 1

- You have a computer system with a single CPU.

  - Both inter-arrival and service times are exponentially distributed.

  - The request only requires services at the CPU.

  - Each request only visits the CPU once.

  - A finished request will leave the system.

  - Mean arrival ra

  - Mean service ti at the CPU is 0.1s.

- What is the utilisation of the

- What is the mean response ti

- The utilisation is pretty high and you want to change the system. You can think of 3 alternatives.

Question 1 - Alternative 1

- Replace the existing CPU by one that is 2 times faster
- You may assume that the service time is inversely proportional to CPU speed.
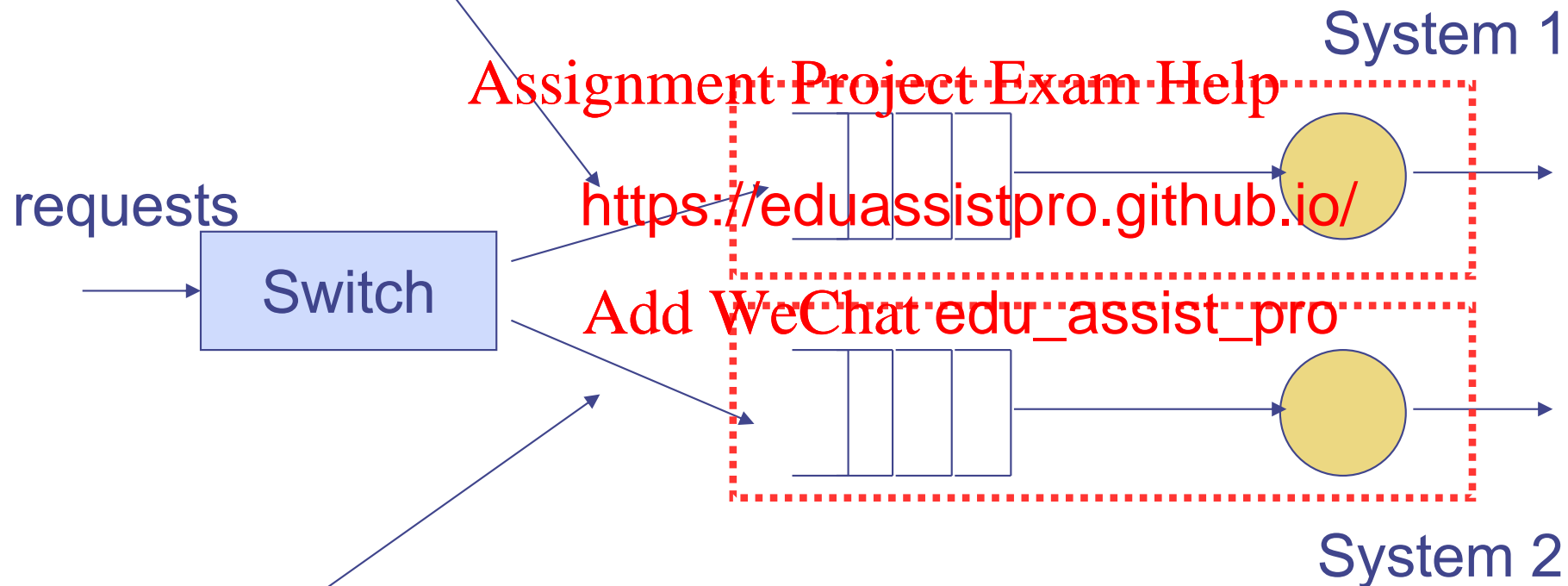
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Question 1 - Alternative 2

- Buy a system which is identical to the current one

- Put the two systems in parallel

- Add a switch in front of the system

- When a request arrives, the switch will randomly assign the request to one of ~~Assignment Project Exam Help~~ age, half of the request goes to e~~https://eduassistpro.github.io/~~

- (Pictorial representation on the ~~Add WeChat edu_assist_pro~~)

- Assume the switch requires ne   e

Half of the requests to system 1

System 1

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requests

Switch

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System 2

Half of the requests to System 2
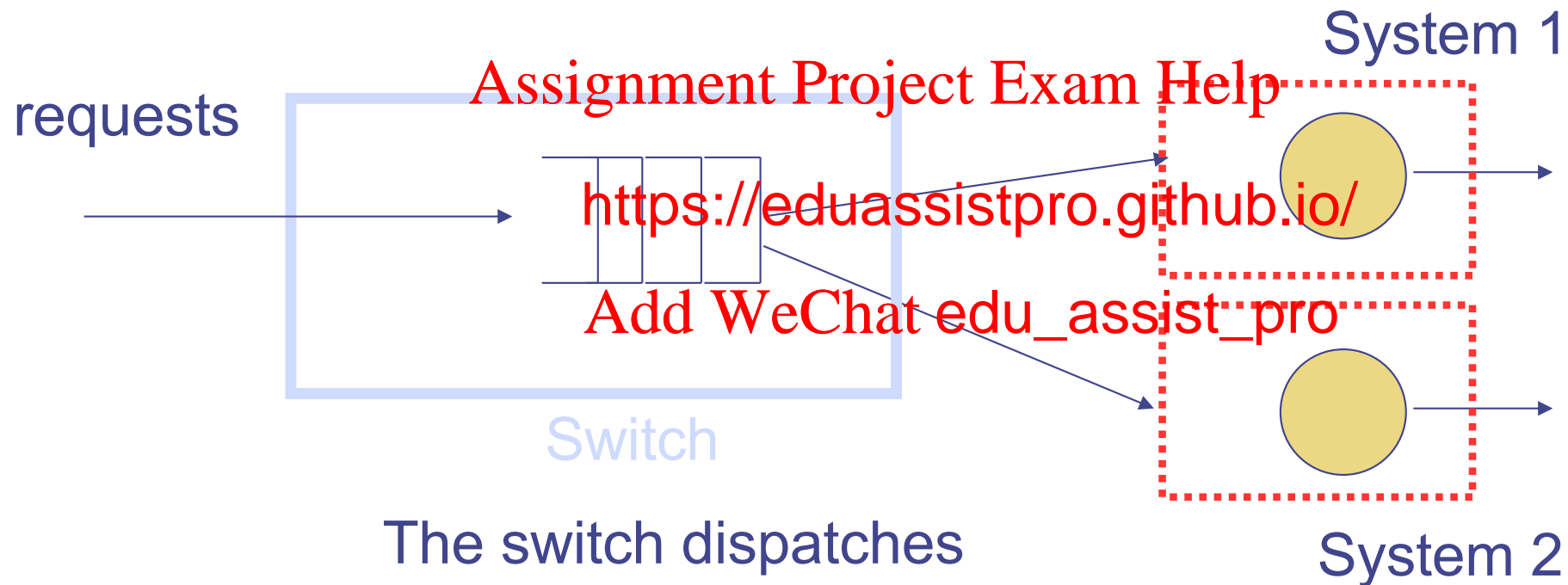
Question 1 - Alternative 3

- Similar to Alternative 2, we buy a system which is identical to the current one and we also buy a switch

- However, we only maintain a queue at the switch

- If both systems are busy, the request waits at the switch; otherwise, the switch dispatches the request to any of the available syste

- Assuming that it or the switch to find out whether a system is idle

- (Pictorial representation on the next page)

System 1

requests

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Switch

System 2

The switch dispatches
the requests to the first
available server.

Question 1

- Part (a): Calculate the resulting mean response time for each for the three alternatives

- Part (b): Repeat part (a) for a number of different mean arrival rates. Plot a graph of arrival rates against the mean response timeAssignment Project Exam Help

- Part (c): What o   ake from these calculations? https://eduassistpro.github.io/

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- Part (d): What is the best way to upgrade the system in terms of performance? However, the best way to upgrade in terms of performance may not be the best way to upgrade in terms of cost, why?

Question 2
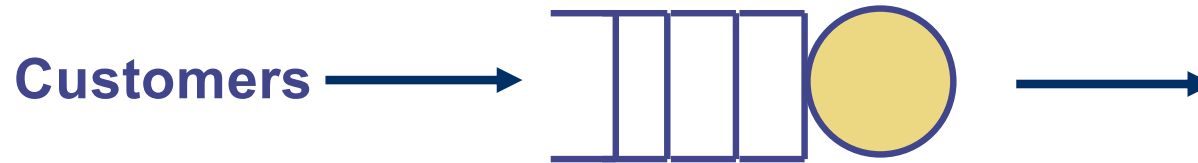
Customers →

- Consider a single server queue as shown above
- Part (a): Consider the situation
  - The inter-arrival time is a constant and is given by 1 second.
  - The service ti   r is always 0.5 second.
  - What is the mea   er?
- Part (b): Consider the situation
  - The inter-arrival time is exponentially distributed with mean 1 second
  - The service time required by each customer is exponentially distributed with mean 0.5s
  - What is the mean waiting time per customer?
- Compare the answers of Parts (a) and (b). What conclusions can you draw?

Question 3

- An Internet Service Provider has 4 dial-up ports. Connection requests obey Poisson distribution with a mean arrival rate of 3 requests per hour. The session duration of each connection request is exponentially distributed with a mean of 1.5 hours. What is the probability that a connection requ