Background

You are working on an online queuing system for clinics that only accept walk-in patients. Through this system, walk-in patients can now queue online and receive real-time updates to their waiting time. Unlike appointments, patients who queue online cannot select their preferred time slots – the system helps them secure a spot in the queue and provides real-time updates to their waiting time based on their queue status.

The patients' waiting times largely depend on (1) the average consultation time of their doctors, and (2) the amount of persons ahead of them in the queue. The longer it takes for a doctor to consult each patient, the longer the remaining patients in the queue have to wait. Similarly, the greater the amount of persons ahead of a patient in the queue, the longer the patient has to wait.

There are many factors that can affect the consultation time. These include emergencies, additional treatments, etc. Moreover, the average consultation time differs from doctor to doctor. For the purpose of this case study, the average consultation time(s) will be given to you and you shall assume those value(s) when working on your answers.

Case Study

Please explain your answers and provide workings, where applicable.

Case Study 1

Clinic X has 1 doctor. The doctor's average consultation time is 3 minutes per patient. Currently, there are 5 patients in the queue and the doctor is not seeing any patient. John decides to queue online and he becomes the 6^{th} patient in the queue, having 5 patients ahead of him. Since there are 5 patients ahead and each taking 3 minutes on average, the waiting time for John is estimated to be 15 minutes.

Question 1:

When should the countdown in waiting time, i.e. from 15 minutes, start for John? The moment he queues online, or when the doctor starts seeing the first patient in the queue?

Question 2:

Suppose the case has changed – at the time John queues online, there are 7 patients ahead of him and **the doctor is currently seeing one of the 7 patients**, **Peter**. Assuming that the doctor's average consultation time per patient is 4 minutes, what will John's estimated waiting time be given that, at the time John joins the queue, Peter has already gone to the consultation room for the following durations?

(a) 2 minutes
(b) 5 minutes

Case Study 2

Clinic Y has 2 doctors, Doctor A and Doctor B. The average consultation times per patient are 3 minutes for Doctor A and 4 minutes for Doctor B. Currently, there are 14 patients in the queue and both doctors are not seeing any patient. John decides to queue online and he becomes the 15th patient in the queue, with 14 patients ahead of him.

Question 1:

Assuming that all the patients in the queue, including John, have **no** specific preferences for the doctors they want to consult, what will John's estimated waiting time be when he joins the queue?

Question 2:

Suppose the case has changed – at the time John queues online, there are 14 patients ahead of him and while Doctor A is not seeing any patient (i.e. Doctor A is available), **Doctor B is currently seeing the first patient, Lucas, who has been in the consultation room for the past 2 minutes**. Assuming that the average consultation times per patient for both doctors remain as 3 minutes and 4 minutes respectively, what will John's estimated waiting time be when he joins the queue?

Bonus

This section is not mandatory.

Write an algorithm in JavaScript to calculate patient's estimated waiting time. The algorithm should work for different amount of doctors and patient queue positions – it should accept an array of Doctor objects and patient's position in queue as inputs and return the patient's waiting time as output. Your codes should also include the implementation for the Doctor class. For simplicity, assume all the patients in the queue have no preference for the doctors they want to consult and all the doctors are available and not seeing any patient initially.