To understand why the mine is still not able to meet it’s optimum production rate, you decide to speak with the field operations manager and understand more about the process happening on the field.

[Business Analyst]: I realise that the mine is not able to meet the production requirements sent by the customers, is that true?

[Field Operations Manager]: Yes, that’s true! We are not able to meet the production required in 1 continuous operation of the mine which is 1 day.   
  
[Business Analyst]: Is the mine already working with the maximum possible diggers and crushers?  
  
[Field Operations Manager]: The field is already equipped with the maximum number of diggers and crushers. That is 7 diggers and 3 crushers. In fact, the field also has the maximum number of trucks that is 35 and each with 230 tons of ore carrying capacity!

That is already enough to produce the requirements that we get from our regular clients.  
  
[Business Analyst]: In that case, is there a sudden increase in the requirements sent by the customer? Is that why the production capacity is not being able to meet the demand?

[Field Operations Manager]: No, that’s not the case, We are still getting the same set of requirements and we don’t see any surge in the demand. The concern is that with the demand not increasing, we are still not able to optimise our production capacity or in a way are operating with less efficiency.   
  
[Business Analyst]: And this is causing distress among the customers?

[Field Operations Manager]: Yes, it is indeed causing distress as we are not able to meet their requirements on time. In fact, we are also losing our brand value as there are rumours in the market on our efficiency and people are not opting to place orders with us and pick other open pit mines, even though they are far away from the customer locations and given that they will take more number of days to send the desired ore composition to the customer, our customers have started preferring them over our mine.  
  
[Business Analyst]: In that case, I believe that there is a problem of not using the existing equipment and resources to their full potential. How are the trucks getting assigned to the diggers and crushers in the present scenario.

[Field Operations Manager]: The assignment of the trucks is right now without any AI or ML model built to help the truck assignment to the digger and the crusher. The trucks are randomly assigned to a digger and a crusher by the field engineers. As soon as a truck gets loaded at the digger assigned to them, they are to move to the crusher and offload the raw ore into the crusher. And then they journey back to the digger to repeat the cycle again.

[Business Analyst]: What is the average waiting time for 1 unloaded/empty truck at the digger? Let’s say that I have 2 trucks lined up near 1 digger. How is the waiting time for the truck calculated?

[Field Operations Manager]: Sure! Let’s say a truck is waiting first in the queue at digger D1. The time taken by the digger to fill the truck to its full capacity is 10 mins. Now, imagine if there are 2 trucks waiting in a queue at the digger. The queue waiting time + loading time for the second truck is 20 mins (10 mins (self-time) + 10 mins (previous truck’s time))  
  
[Business Analyst]: Understood! And the same time applies for the trucks waiting in a queue at the crusher as well?

[Field Operations Manager]: No! The queue waiting + offloading time for 1 truck at any crusher is 5 mins. Here again, in case of 2 trucks, it will become 10 mins (5 mins (self-time) + 5 mins (previous truck’s time))  
  
[Business Analyst]: Understood! What happens to the production or the queue time if there are loaded trucks in between the empty trucks waiting at a digger?   
  
[Field Operations Manager]: That’s a very valid question! The digger serves the truck if it is empty and loads it with the raw ore. But if it encounters an already loaded truck waiting in the queue for it, the digger stops operating and cannot function until it encounters an empty truck again. Until the loaded truck is cleared by the field engineer, the other empty trucks waiting in line at the digger also go useless and their queue time gets increased as it is dependent on how fast the loaded truck gets cleared.  
  
[Business Analyst]: That’s interesting! And in the same fashion, the production at the crusher or the queue time gets affected if it encounters an empty truck?

[Field Operations Manager]: That’s right! The loaded trucks will dump their ore into a crusher. If the crusher encounters an empty truck in between the loaded ones, again, the ore production/processing stops for the crusher until the empty truck is cleared from its queue. Only once this is cleared, the next loaded trucks can serve the crusher.  
  
[Business Analyst]: Hmmm. This looks like an interesting problem. Can you help me with the current status and the assignment of the trucks at each of the diggers and the crushers?

[Field Operations Manager]: Yes sure! Here you go. I am sharing the snapshot at this time of the day. But I would like you to take a note of one thing. It might happen that in this data there are more number of trucks present at a particular digger or crusher than the others, but don't take the number to be a concern since this is just a data snapshot at a particular time of the day.

[Business Analyst]: Okay, noted. Thanks!