Practice Questions

This is a small sample of the types of questions you can expect on the exam. I am not putting these questions on the canvas quiz format. You can expect that with these questions I will ask you to do things like input the optimal solution, select which constraints are binding, input the optimal objective,…

1) The area of a triangle with sides of length a, b, and c is $\sqrt{s(s-a)(s-b)(s-c)}$ where s is half of the perimeter of the triangle. We have 60 ft of fencing and want to make a triangular fence which contains as much area as possible. Formulate and solve an NLP to find the optimal side lengths of the fence.

2) You enjoy working out. You have time to make it to the gym 3 days per week: Monday, Wednesday, and Friday. On Monday you go on your lunch break for 1 hour, on Wednesday you work out after work for 2 hours, and on Friday you take a long lunch for 1.5 hours at the gym. Each time you're at the gym you can focus on two areas: cardiovascular health, and muscle development. But you must also spend time warming up before working on either of those areas. For every hour you spend doing cardio your health is increased by 10 units. For every hour you spend working on muscle development your health increases by 8 units. For every hour you spend warming up your health increases by 3 units. On Wednesdays after work, you can run outside because the temperature is pleasant in the evening, so you want to spend at least 1.2 hours of your Wednesday workout on cardio. On Monday during lunch the treadmills are busy, so you don't want to spend more than 0.25 hours of your time on cardio that day. On Fridays, lots of dudes at the gym wants to pump up their muscles for a night at the club, so the weights are busy, and you don't want to spend more than 0.15 hours of your time on muscle development on Fridays. For every hour you spend on cardio you must spend at least 0.1 hours warming up on that day. For every hour you spend working your muscles, you must spend at least 0.15 hours warming up on that day. So, if on Wednesday you spend 0.5 hours on cardio and 0.5 hours on muscles, then you must spend 0.1/2+0.15/2=0.125 hours warming up. In aggregate, over the week, you can't spend more time on cardio than double your muscle time.

   You want to allocate your time spent at the gym to maximize your total healthiness. Let M_c, M_m and M_w be the time (in hours) on Monday that you spend on cardio, muscles, and warmup. Define similar variables for Wednesday and Thursday. Formulate and solve this problem

3) Build a neural network that uses the x data in the train.csv file to predict if the corresponding y value is 0, 1, or 2. This neural network should have:
   a. Input layer

b. Dense layer with 40 neurons, relu activation, and ridge regularizer with penalty term=1e-3
c. Dense layer with 15 neurons, relu activation
d. Dropout with 15% probability of zero
e. Output layer with the appropriate activation function

Train this neural network using the adam optimizer, with the default learning rate for 100 epochs, and a batch size of 20. Don't use any of the training data for validation. What is the accuracy on the test.csv file?