Name:

Quiz 5 – 3/3/2022

Problem	Weight	Score
1	1	
Total		/ 10

Instructions. You have 15 minutes to complete this quiz. You may <u>not</u> use any other materials (e.g., notes, homework, website).

<u>Show all your work.</u> To receive full credit, your solutions must be completely correct, sufficiently justified, and easy to follow.

Problem 1. One common task at Navy Munitions Command Detachment Sewell's Point is to transport munitions by truck to a pier for eventual loading onto a ship. Suppose you are in charge of determining which subset of the following munitions should be loaded on the next truck:

		Capability Value	Net Explosive Weight (tons)	Area (ft^2)
1	Standard Missile MK13	7	2	70
2	Standard Missile MK15	10	3	70
3	Standard Missile MK21	5	4	80
4	Tomahawk	8	1	60

For this problem, assume there is only one of each munition type. The truck is allowed to transport at most 8 tons of net explosive weight (NEW), and has an area capacity of 200 ft^2. Your goal is to maximize the total capability value of the munitions on the next truck.

We can formulate this problem as a dynamic program by giving its longest path representation. In particular, we define the states and stages as follows:

$$\text{Stage } t \leftrightarrow \begin{cases} \text{considering munition } t & \text{for } t = 1, 2, 3, 4 \\ \text{end of the decision making process} & \text{for } t = 5 \end{cases}$$

$$\text{Node } t_{n_1, n_2} \leftrightarrow \text{having } n_1 \text{ remaining NEW capacity and } n_2 \text{ remaining area capacity at stage } t$$

$$\text{for } n_1 = 0, \ldots, 8; n_2 = 0, \ldots, 200$$

Define the following notation for $t = 1, 2, 3, 4$:

$$v_t = \text{capability value of munition } t \qquad w_t = \text{NEW of munition } t \qquad a_t = \text{area of munition } t$$

Sketch the edges from node t_{n_1, n_2} in stage t to all the relevant nodes in stage $t + 1$. Specify the edge lengths.

$$\boxed{t_{n_1, n_2}}$$