**Question 1 [12 marks]:**

Consider the instance of a discrete knapsack problem with the knapsack capacity 10 and the item information as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Weight | Value | Value per 1 weight |
| 1 | 4 | $120 | $120 / 4 = $30 |
| 2 | 3 | $600 | $600 / 3 = $200 |
| 3 | 3 | $510 | $510 / 3 = $170 |
| 4 | 5 | $540 | $540 / 5 = $108 |

Find the most valuable subset of the items that fit into the knapsack.

We will be using the highest value per weight method

Current total weight = 0

Current value = 0

1st round taking the highest value/weight item, we will take item 2

Current total weight = 3

Current value = $600

2nd round taking the 2nd highest value/weight item, we will take item 3

Current total weight = 6

Current value = $1110

3rd round as we only have 4 capacities left, we can only take item 1

Current total weight = 10

Current value = $1230

So for this method, the current items would be item [2, 3, 1] with a total value of $1230

If we did not consider value/weight it would be

Current total weight = 0

Current value = 0

1st round we will take the highest value which is item 2

Current total weight = 3

Current value = $600

2nd round we will take the 2nd highest value which is item 4

Current total weight = 8

Current value = $1140

As the current total weight is 8, we are unable to add another item to it  
So for this method, the highest value is only $1140 using item [2, 4]