Problem Set #3: CMPSC 463

1. (20 points) You have a large collection of images, $image_1$, $image_2$, …, $image_n$, that you wish to store on 100GB USB flash drives. You are given an array `size`, where `size[i]` is the size of the $image_i$ in GB. You may reorder the images as you write them to the drives. You are using a greedy strategy that fills one drive at a time, writing the largest unwritten image to the current drive. When there are no more images that will fit on the current drive, you start filling the next one.

   If the goal is to use as few flash drives as possible, is this algorithm correct? You must provide a justification for your answer to receive credit.

2. (40 points) You have a large collection of images, $image_1$, $image_2$, …, $image_n$, that you wish to store on 100GB USB flash drives. You are given an array `size`, where `size[i]` is the size of the $image_i$ in GB. The goal is to use as few flash drives as possible, while storing the images in order. In other words, $image_1$ through $image_i$ must be stored on drive 1, $image_{i+1}$ through $image_j$ on drive 2, $image_{j+1}$ through $image_k$ on drive 3, etc.
   a. Provide an efficient and correct algorithm to allocate images to drives.
   b. What is the time complexity of your algorithm? Use asymptotic notation. Justify your answer.
   c. Prove that your algorithm is correct.

3. (40 points) In the game *Angry Dogs*, you launch dogs at cars that are arranged in a line. You get one point for every car within 100 feet where the dog lands. Suppose that you are given an array `car[1..n]` with car locations (given in feet).
   a. Write an efficient and correct algorithm that minimizes the number of dogs launched while achieving the maximum score.
   b. What is the time complexity of your algorithm? Use asymptotic notation. Justify your answer.
   c. Prove that your algorithm is correct.