CS3243 Assignment 3

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Q3.

h1 is **admissible**. Assuming the scenario where there are no obstacles present such that h\*(n) is minimised without increasing h1(n) and let N be the number of pellets remaining in the environment, take any one of the nearest pellets from the Pac-Man (shortest Manhattan distance) as the base case such that the pellet is the only pellet in the environment (i.e. N = 1). Since the moving of 1 position up, down, left or right is 1 action cost, the minimum optimal cost would be the Manhattan distance of that pellet from the Pac-Man. Since the number of pellets will always be less than or equals to the Manhattan distance of that pellet from the Pac-Man, h1(n) <= h\*(n) for N = 1.

Assuming that h1(n) <= h\*(n) when N = k for some positive integer k, when N = k+1, h1(n) increases by 1, but increase in h\*(n) is more than or equals to 1 as the Manhattan distance of the (k+1)-th pellet from the k-th pellet is more than or equals to 1. Hence, h1(n) will always be less than or equals to h\*(n) when N = k, some positive integer k.

Therefore, by mathematical induction, h1(n) <= h\*(n) and thus h1 is admissible.

h2 is **inadmissible**. If there is only one pellet in the maze and is directly 1 position beside the Pac-Man, h\*(n) is 1. However, number of pellets in this case is 1 and the minimum Manhattan distance of the pellet to the Pac-Mn is 1. This means that h2(n) = 1 + 1 = 2 is greater than h\*(n) which is 1. Hence, h2 is inadmissible.

h3 is **admissible**. The best case scenario for the Pac-Man to get to a pellet is when there is no obstacles in between the Pac-Man and the pellet. The most optimal path in this case will have a cost equivalent to the Manhattan distance of the pellet from the Pac-Man because moving a position incurs an action cost of 1. As it is impossible to get to a pellet with a lower cost than the Manhattan distance of the pellet from the Pac-Man, the Manhattan distance of any pellet including the furthest pellet from the Pac-man, would be less than the h\*(n) and thus h3 is admissible.

h4 is **admissible**. Since the average Euclidean distance of each pellets from the Pac-Man will always be less than or equals to the maximum Euclidean distance from the Pac-Man among those pellets; and the maximum Euclidean distance of the pellets from the Pac-Man will always be less than or equals to the Manhattan distance of that pellet from the Pac-Man, h4 <= h3. As h3 is admissible, therefore, h4 is admissible.