8.18)

The best way for finding the height is through a greedy algorithm to put the biggest height books together until they cannot fit and then move to the next shelf when there is no more room. To prove this, a non-greedy algorithm might put books all on different shelves as the height decreases, so each shelf has 1 book then 2 and so on. Since all books have the same height in this problem, the height of the shelves will be greater than the greedy algorithm because if a shelf is not completely filled, then that shelf still counts in the height, but the extra books that aren't added there must be added somewhere else. This results in the height of the greedy algorithm being shorter or equal to the height of the non-greedy algorithm. Since it will either be better or the same, the greedy algorithm is the way to go to find the optimal height for the bookshelf. The time complexity for this problem is determined by the number of books (n) so by adding one book at a time, this problem takes O(n) time.

8.19)

a) If there are multiple heights (example 1,2,3,4,5) and a shelf can fit the books with height 4, 3 and 2 , then the other shelf will have 5 and 1 and the max height will be 4 +5 = 9. If the book with height 4 is switched to the shelf with 5 and 1, then the new max height is 3 + 5 = 8 and is less than the greedy algorithm.

b) To calculate this total height, one can use the formula C(i) = min(C(j+1)) + min (height(i)) where i is the number of books and j represents the total width of the shelf.