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Q.1.

1. No: $\{(1,8), (7,10), (9,20)\}$
   $\quad 7 \quad\quad 3 \quad\quad 11$

   if we chose shortest, then only $(7,10)$
   but we can choose $(1,8)$ and $(9,20)$

2. No: $\{\underset{3}{(-1,1)}, \underset{4}{(1,5)}, \underset{3}{(0,2)}, \underset{3}{(0,2)}, \underset{3}{(0,2)}, \underset{2}{(4,7)}, \underset{4}{(6,8)}, \underset{4}{(7,10)}, \underset{4}{(7,10)}, \underset{4}{(7,10)}, \underset{3}{(9,20)}\}$

   Follow the strategy would choose $(4,7)$ first, but the only solution is $\{(-1,1), (1,5), (6,8), (9,20)\}$

3. Yes. Because it is actually do the activities in the reverse order, it can obviously give an optimal solution in the same. Every time we choose the best choice.

4. No $\{(1,7), (2,3), (4,5)\}$

   Follow the strategy will chose $(1,7)$ only, but the solution is $\{(2,3), (4,5)\}$

Q.2. According to the fractional knapsack problem, we will choose the highest value density we can. Assume the solution is $S = \{s_1, s_2 \cdots s_n\}$. Use greedy algorithm works by assign $s_n = \min(w_n, W)$ and then solve the subproblem with $\{v_1, v_2 \cdots v_{n-1}\}, \{w_1, w_2 \cdots w_{n-1}\}, W - w_n$

Proof by contradiction: Suppose there is solution $s_1, s_2 \cdots s_n$ that $s_n < \min(w_n, W)$, then we can replace the smallest i $(s_i > 0)$'s s_i to $\max(0, W - w_n)$ and increase s_n to the same amount. then we get a better solution, which lead to a contradition. Hence the problem has the greedy-choice property.