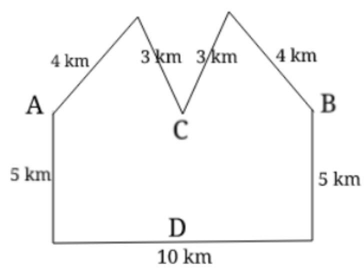
1. Finding counterexamples.

1-1. *Soln.* Let $a = b = -1$, then $-1 - 1 = -2 < -1 = min(-1, -1)$.

1-2. *Soln.* Let $a = -1$ and $b = 2$, then $-1 * 2 = -2 < -1 = min(-1, 2)$.

1-3. *Soln.* Consider a road network where A, B and C are points. The road A to C is $3[km]$, C to B is $4[km]$, and A to B is $5[km]$. Suppose the roads AC and CB let you travel $2[km/h]$ and the road AB lets you travel $1[km/h]$. Then $7[km] > 5[km] \iff AC + CB > AB$, so A to B is the shortest route. But $\frac{7[km]}{2[km/h]} = 3.5[h] < 5[h] = \frac{5[km]}{1[km/h]}$, so A to C to B is the fastest route.

1-4. *Soln.*



Consider the road network above where A, B, C and D are points. Observe that the route A to D to B is $5 + 10 + 5 = 20[km]$ and has two turns, while the route A to C to B is $4 + 3 + 3 + 4 = 14[km]$ and has three turns. Thus the former has fewer turns but the latter is shorter.

1-5. *Soln.*

(a) Let $T = 4$ and $S = \{1, 2, 3\}$. The algorithm adds $\{1, 2\}$ to the knapsack, with 1 unit remaining. But the subset $\{1, 3\}$ fills the knapsack completely.

(b) Let $T = 2$ and $S = \{1, 2\}$. The algorithm adds $\{1\}$ to the knapsack, with 1 unit remaining. But the subset $\{2\}$ fills the knapsack completely.

(c) Let $T = 4$ and $S = \{3, 2, 2\}$. The algorithm adds $\{3\}$ to the knapsack, with 1 unit remaining. But the subset $\{2, 2\}$ fills the knapsack completely.

1-6. *Soln.* Let $U = \{1, 2, 3, 4, 5, 6\}$ and $S_1 = \{1, 2, 3, 4\}$, $S_2 = \{1, 2, 5\}$ and $S_3 = \{3, 4, 6\}$. The algorithm picks S_1, S_2 and S_3, but observe that $S_2 \cup S_3 = U$, thus all elements can be covered with fewer subsets.