1. Suppose that you own a TV channel and there are many companies that wants to show their advertisement on you channel. You have to decide which commercials to show in order to maximize the amount of money you receive from those company. Commercial break time is limited so you can show any advertise partially, e.g. if a company has some commercial of length 50 seconds you can chose to broadcast that commercial for 30 seconds. So your goal is the following: Given a set of TV commercial $S = \{(t_i, v_i)\colon t_i\ time\ of\ commercial, v_i\ profit\ of\ commercial\}$
   And a limited amount of time period T. Design and implement an algorithm to maximize your total profit by broadcasting those commercial within the time limit T, in $O(n \lg n)$ time. Your program must print the maximum optimal profit to be gained and also which advertisement to show for how much time.
2. Suppose that you are given a set $S = \{s_i |\ s_i \in \mathbb{R}\ for\ i = 1 \dots n\}, |S| = n.$ You are also given an integer parameter k. Design and implement an algorithm that will minimize the number of 1D line segments, required to cover all $s_i \in S$ in such a way that each such line segment is of length at most k. Your program should print the minimum number of line segments used along with the two end points of the line segments.
   [Bonus point, should your algorithm run in $O(n)$ time]
3. Given a set of activities $S = \{(s_i, f_i) |\ 0 \le s_i \le f_i < \infty\}\ |S| = n.$ design and implement an algorithm that will select a subset of mutually exclusive (or non-overlapping) activities $B \subseteq S$. Your objective should be to:
   $\max |B|$
   s. t. $f_i \le s_j or\ f_j \le s_i$ for any two $i, j \in [1, n]$