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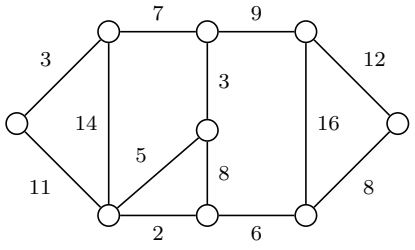
Exercise 4

Task 1
Show that the median of five numbers can be computed using six comparisons.

Task 2
Compute a spanning subtree of maximal weight using Kruskal's algorithm for the following graph:



Task 3

(a) Show that for each tree $T = (V, E)$ with $|V| > 0$ we have $|E| = |V| - 1$.

(b) Show that every connected graph has a spanning subtree.

Task 4
Which of the following pairs is a subset system, respectively matroid?

(a) $(\{1,2,3\}, \{\emptyset, \{1\}, \{3\}, \{1,2\}\})$

(b) $(\{1,2,3\}, \{\emptyset, \{1\}, \{2\}, \{3\}, \{2,3\}\})$

(c) (E, U), where E is a finite set and $U = \{A \subseteq E \mid |A| \leq k\}$ for a $k \in \mathbb{N}$.

(d) (E, U), where E is a finite set, $\{E_i \mid 1 \leq i \leq k\}$ is a partition of E and

$$U = \{A \subseteq E \mid |A \cap E_i| \leq 1 \text{ for all } 1 \leq i \leq k\}.$$