Answer 4-a:
Assume that T1 is not the MST, hence, there exist some tree T2 not equal T1 that is
the MST.
From the question we know that:
(*) Max \{E1\E2\} < Max \{E2\E1\}
Let e2 be the edge in \{E2\E1\} that has the maximal weight.
Remove e2 from the T2 tree. In T2 two different connected components, CC1 and
CC2, are created.

Claim:
Exists and edge e1 ∈ \{E1\E2\} that connects CC1 and CC2
Proof:
T1 is a spanning tree, therefore must have some edge (e1) which connects
vertices in CC1 and CC2. Moreover, this edge (e1) cannot be a part of T2,
because if it was than we would form a cycle in (the original) T2 (CC1->e2->
CC2->e1->CC1).
Q.E.D.

Create a new tree T3 that is created as T2-{e2}+{e1} (the edge e2 is replaced with
e1). This tree is a spanning tree, since CC1 and CC2 are still connected components
and e1 connects those two parts of the graph.

Let us calculate the weight of the tree T3: Weight(T3) = Weight(T2)-w\{e2\}+w\{e1\}.
By condition (*) it holds that w\{e2\}>w\{e1\}, therefore weight\{T3\}< weight\{T2\} in
contradiction to the definition of T2 as the MST.
Conclusion: T1 is the MST.

Answer 4-b:
We prove in 2 stages:
Stage 1 – prove that we get a tree from the algorithm
Stage 2 – prove that this tree is the MST

Stage 1
Stage 1.1 – prove we get a connected graph:
We start from graph G, which has only one connected component.
In every iteration we exclude an edge e(i) only if the connectivity remains – so
in the end we get a connected graph for sure, which spans all vertices.
Stage 1.2 – prove that we get an acyclic graph
If there was some circle, than at some iteration k we get to one of the circle's
members. We are sure that at this point we break the circle, because the
remaining graph is connected through the other edges in the circle – we are
sure to get an a-cyclic graph.
\rightarrow We proved a connected, a-cyclic, spanning graph = spanning tree

Stage 2
Because of the way the algorithm is built, the tree got holds the same assumption from
section 4-a: Max \{E1\E2\} < Max \{E2\E1\} for any T2.
So from section 4-a we deduce that this tree really is the MST.
Quod Erat Demonstrandum.