1. SKS would have a polytime algorithm. This is because CLIQUE is NP-complete, so if it has a polytime algorithm, it follows that $P = NP$. If $P = NP$, then SKD is in P (since SKD is in NP). But we have shown that SKS $\xrightarrow{p}$ SKD, hence SKS would have a polytime algorithm.

2. (a) Verify that B is even and $|V| \geq B$. Guess-and-check algorithm: *guess* a subset $V' \subseteq V$, and *check* that $|V'| = B$, and that every pair of distinct nodes in V' is connected by an edge from E.

   (b) CLIQUE $\leq_p$ EVEN CLIQUE.

   (c) Given an instance $\langle G, B\rangle$ to CLIQUE, we construct and instance $\langle G', B'\rangle$ to EVEN CLIQUE such that: *G has a clique of size B iff G' has a clique of size B'.*

   (d) case I: B is even. Then $G' = G$ and $B' = B$.
   case II: B is odd. Let $B' = B + 1$, and let G' be G together with one extra vertex v_0, and v_0 is connected to every node in G.

   (e) If B is even, then $G' = G$, and $B' = B$, so there is nothing to prove. Suppose that B is odd. ($\Longrightarrow$): Let $U \subseteq V$ be a clique of size B in G. Then, $U \cup \{v_0\}$ is a clique of size $B + 1$ in G'. ($\Longleftarrow$): Let $U \subseteq V \cup \{v_0\}$ be a clique of size $B' = B + 1$ in G'. Then, there is at least one vertex u_0 in U, and so $U - \{u_0\}$ is a clique of size B in G.

3. (a) False: Let $L_2 = \Sigma^*$. Then L_2 is trivially semi-decidable. But $\overline{A_{\mathrm{TM}}} \subseteq \Sigma^* = L_2$, and it is not semi-decidable.

   (b) True: If L is finite, then L is decidable. Otherwise, we design a TM M based on E such that $L = L(M)$ and M halts on every input:

   > On input x, M simulates E on a blank tape. If E outputs x, then M accepts. If E outputs a string y such that $|y| > |x|$, then M rejects.

   Clearly $L = L(M)$. To see that M always halts, note that for any fixed string x there are finitely many strings y such that $|y| \leq |x|$. So, since L is infinite, at some point E is going to output a y such that $|y| > |x|$, after which we know for sure that E will never output x.