3. **[Electric vehicles]** Consider a city network where we need to route a set of electric vehicles which may require to be charged during its journey from some source to some destination. Let us assume that we have $n$ cities $(v_1, v_2, \ldots, v_n)$ and the distance between cities $v_i$ and $v_j$ be $e_{ij}$ (if two cities are not connected directly then $e_{ij} = \infty$ and $e_{ij} = e_{ji}$). Assume that each city has a single charging station which can charge one EV at a time. Consider a set of $k$ EVs namely $P_1, P_2, \ldots, P_k$. For each EV the following information is provided -

   (a) $S_r$ - source node

   (b) $D_r$ - destination node

   (c) $B_r$ - battery charge status initially

   (d) $c_r$ - charging rate for battery at a charging station (energy per unit time)

   (e) $d_r$ - discharging rate of battery while traveling (distance travel per unit charge)

   (f) $M_r$ - maximum battery capacity

   (g) $s_r$ - average traveling speed (distance per unit time).

   Assume that all vehicles start their journey at $t = 0$ and $P_r$ reaches it destination at $t = T_r$. We need to route all the vehicles from their respective sources to destinations such that $\max\{T_r\}$ is minimized. You need to develop both optimal as well as heuristic algorithms.