Q5.

$$\max \sum_{p \in P} x_p$$

s.t. 1. $\sum_{p: e \in p} x_p \le c_e \quad \forall e \in P$

2. $x_p \ge 0 \quad \forall p \in P$

In this problem xp represents flow over paths, Constraint 2 ensures nonnegative edges. an constraint 1 ensures no edge goes above it's constraint. A maximized Flow graph is only maxed if all subpaths are maxed, since that is what the linear program maximizes, this linear prog solves max flow

b)

$$\text{Min} \sum_{(u,v) \in E} c(u,v) y_{u,v}$$

Constraints

1. $\sum_{(u,v) \in P} y_{u,v} \ge 1 \quad \forall P \in P$

2. $y_{u,v} \ge 0 \quad \forall (u,v) \in E$

c). Prove that every cut provides a feasible soln to dual linear prog equals capacity of cut

Let $y_{u,v} = 1$ if $u \in A$ and $v \notin A$, else $y_{u,v} = 0$. Then

$$\sum_{uv} c(u,v) y(u,v) = \sum_{u \in A, v \notin A} c(u,v) = \text{capacity}(A)$$