[redacted]

2. Given $G=(V,E)$, edge weights c_e:

① Find optimal tour length, call it L. Let $T=\emptyset$

② For $e = 1, \ldots, |E|$:

Let $c_e = c_e + 1$.

Find optimal tour length, L_e.

If $L_e > L$

edge e must be in tour.
Mark e and set $c_e \leftarrow c_e - 1$ (original value)
Let $T \leftarrow T \cup \{e\}$.

Else

edge e is not in tour.
Leave c_e at modified value

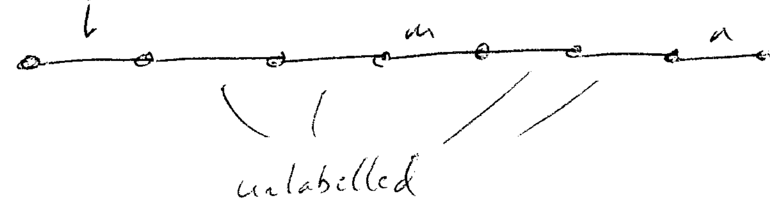
Endif

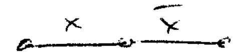
③ Optimal tour consists of edges in T.

The example where every $c_e = 1$ shows that we must leave modified c_e's at modified values if edges not in tour.

3. Reduce 3-SAT to Matching with Bonds:

Map clause $C = l \vee m \vee n$ to graph component:



For every variable x, set up 

Create bonds: every ~~literal~~ edge corresponding to a literal l is put in a bond.

Then an instance of 3-SAT with k clauses and v variables is feasible if and only if $\exists$ matching with bonds with $\geq 3k + v$ edges.

4. For $\begin{bmatrix} 2 & x_{12} \\ x_{12} & 1 \end{bmatrix}$ to be psd, need $-\sqrt{2} \le x_{12} \le \sqrt{2}$.

So optimal value is $\sqrt{2}$, and optimal solution is $x_{12} = \sqrt{2}$.

However, this irrational number cannot be written in polynomial time, so the problem is not solvable in polynomial time.