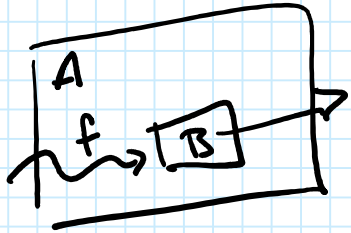
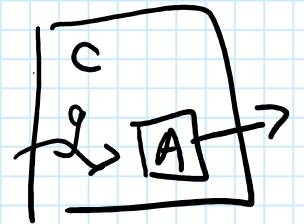


$A \leq_p B$ and A is NP-complete



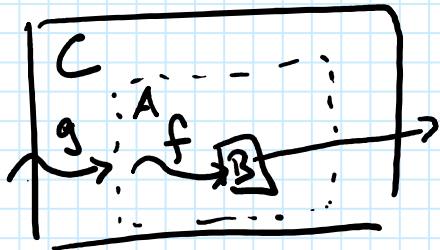
thus $A \in NP$
and A is NP-hard

for any $C \in NP$, $C \leq_p A$



Is B NP-hard?

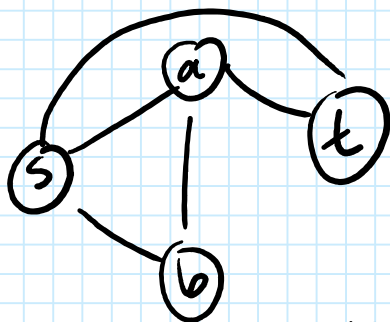
Need to check for any $C \in NP$, $C \leq_p B$:



Big idea: \leq_p reductions are transitive.

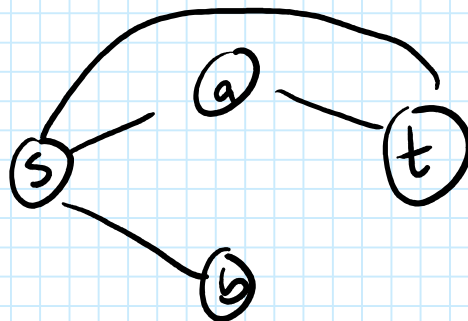
Example HAM PATH input:

YES input: s, b, a, t



input to TSP: $n=4$
 $b=n+1=5$
 $d=1$

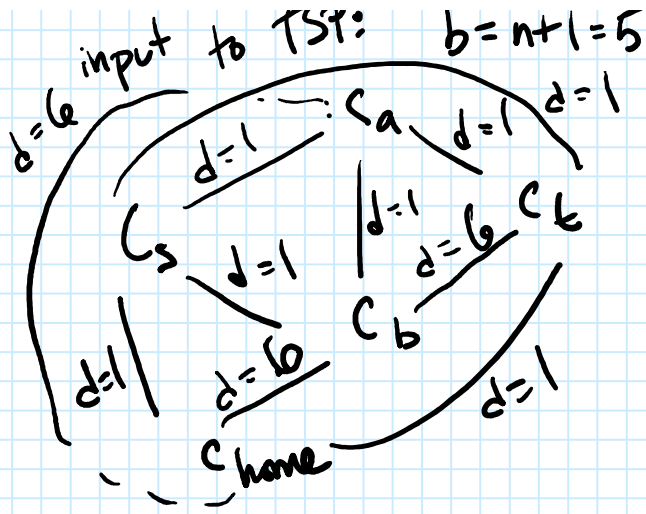
No input



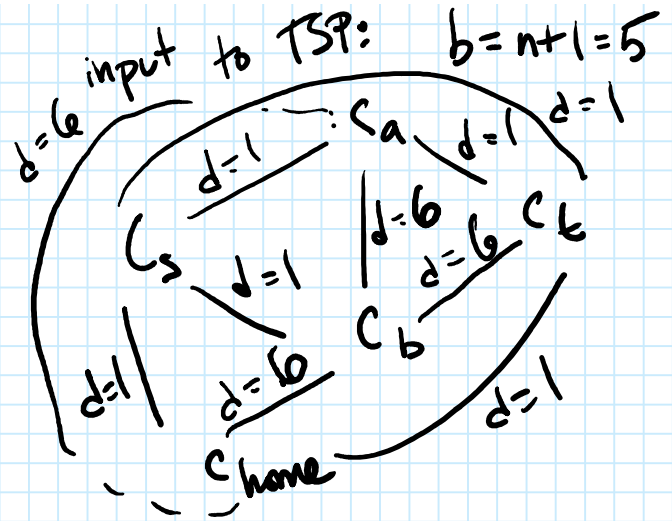
input to TSP: $n=4$
 $b=n+1=5$

(badly formatted)





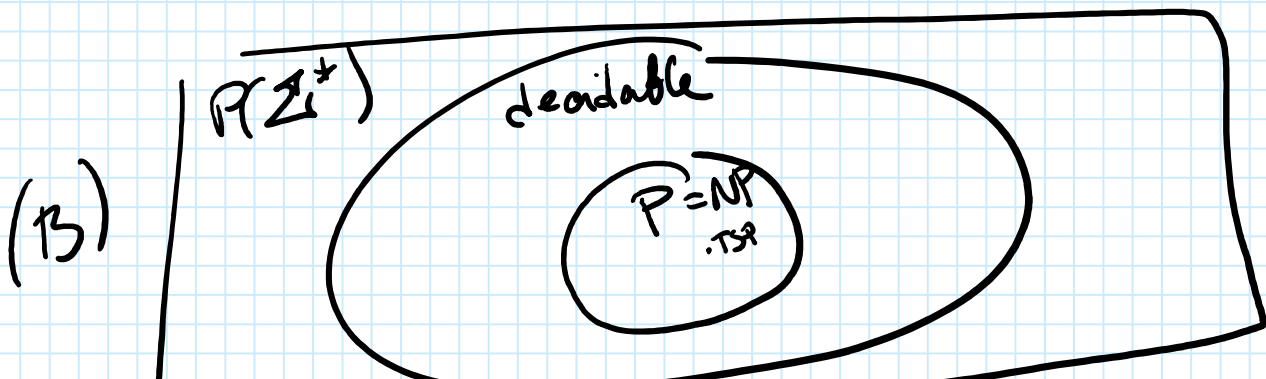
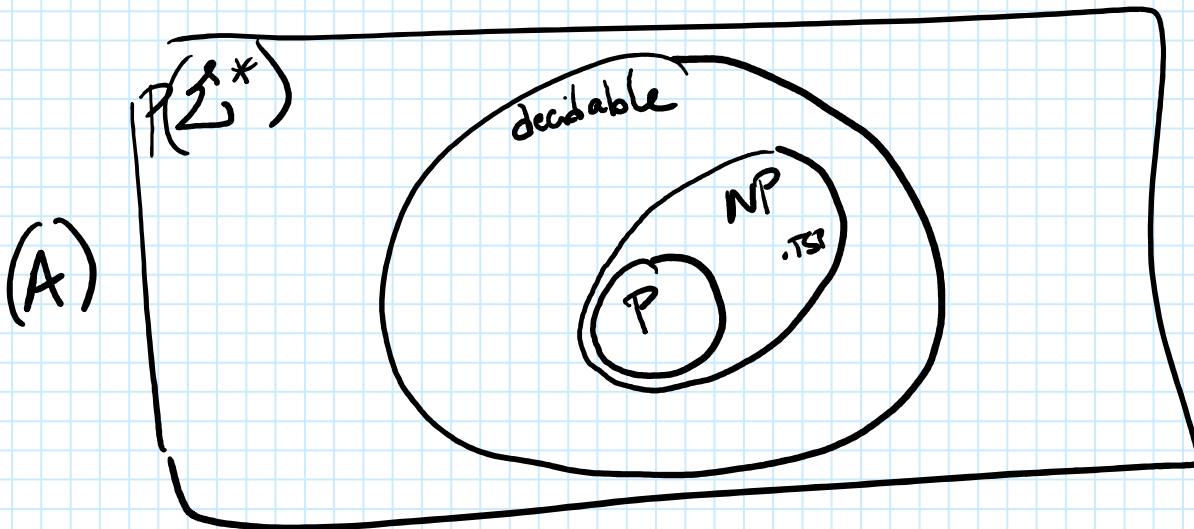
trip: home, C_s , C_b , C_a , C_t , home
 total travel dis: $5 \leq 5$ ✓



trip: home, C_s , \rightarrow , \rightarrow , C_t , home

no possible way to fill in the middle cities which will stay $\leq b$ in total distance travelled

What does the universe look like?



we don't know which of these is true

we