## CS 312: Algorithm Analysis

## Homework Assignment #20

8.1 Assume that $TSP(G, b)$ returns `false` if no tour of length $b$ or less exists in $G$. Then the following functions solve $TSP - OPT$ using $TSP$.

```
TSP-OPT(G)
    S = 0
    for all u ∈ V, v ∈ V:
        S = S + dist(u, v)
    return BINARY-SEARCH-TOUR(G, 0, S)


BINARY-SEARCH-TOUR(G, l, u)
    b = (l + u)/2
    if TSP(G, b) ≠ false
        return BINARY-SEARCH-TOUR(G, l, b)
    else return BINARY-SEARCH-TOUR(G, b, u)
```

Basically, the algorithm just does a binary search over all possible lengths of the optimal tour, going from 0 to the sum of all distances. Note that binary search is necessary here and we can't just increment the value of $b$ by 1 each time since the sum of all distances is exponential in the size of the input.

8.3 It's a generalization of SAT. Given a SAT formula φ with n variables, (φ, n) is an instance of STINGY SAT which has a solution if and only if the original SAT formula has a satisfying assignment.