CSC373H1 Summer 2014 Assignment 4

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Acknowledgements:

"We declare that we have not used any outside help in completing this assignment."

Name: John Armstrong, Henry Ku Date: July 27, 2014

Q1. The Mute Prison

Claim: The mute prison problem is NP-complete.

Proof:

1. Show the mute prison problem is NP.

2. Show the mute prison problem is NP-hard.

1. Suppose we are given a certificate S and have access to value k and matrix T. We can verify that the certificate is satisfiable in the following way. Suppose each element in S represents an inmate. Verification would involve iterating on each inmate in the following way:

```
for inmate in S do
    j = 0;
    while j ⩽ m do
        if T[inmate, j] then
            for (otherinmate ≠ inmate) in S do
                if T[otherinmate, j] = 0 then
                    S is not a subset of inmates who do don't speak the same language;
                end
            end
        end
        j++;
    end
end
```

Clearly, the verification that S is a subset where no two inmates speak the same language can run in polynomial time $O(mn^2)$. Once this verification if complete all that is left to do is to verify that $|S| \geqslant k$, which is $O(1)$. Therefore the mute prison problem is NP. ■

2.

Q2. The Nonsense Prerequisites

Q3. T-rex Christmas

Q4. Vertex Cover