HW 10 CMSC 452. Morally Due April 17

1. (5 points) What is your name? Write it clearly. Staple the HW.

2. (30 points) Show that the following problem is in NP:

All $(A, b)$ where

(a) $A$ is an $n \times n$ matrix of integers.
(b) $b$ is a vector of $n$ integers
(c) There exists a vector $x$ of integers between -5 and 5 such that $Ax = b$
(d) (Think about- not to be handed in) If we allow $x$ to be a rational then is the problem still in NP? If we allow $x$ to be any integer (so remove the bounds -5 to 5) then is the problem in NP?

3. (30 points) If $G = (V, E)$ is a graph then $X \subseteq V$ is a Vertex Cover if for every $e \in E$, there is a $v \in X$ that is the endpoint of $e$.

Show that the following problem is in P:

$$\{G : G \text{ has a vertex cover of size } 17 \}$$

4. (40 points) Describe an NFA with $\leq 500$ states (it will actually be far less than this) for the set

$$\{a^y : (y \neq 999) \land (y \neq 1000)\}$$

Prove that it works by showing that if $a^y$ is rejected then $y = 999$ or $y = 1000$.

HINT- For the big loop use 32 and 33. You may USE the fact that

- For all $n \geq 992$ there exists $x, y \in N$ such that $n = 32x + 33y$.
- There does not exist $x, y \in N$ such that $991 = 32x + 33y$. 