CS 373 Fall 2010
Quiz 3 Solutions

Lecture 1 - Mahesh

1. C. The machine is in state $q_1$ reading a 1. It moves to $q_2$, writes a 0, and moves left.

2. A. $M$ rejects the empty string and $1\{0 \cup 1\}^*$. It accepts 0 and rejects $0\{0 \cup 1\}^+$.

3. B. At the least, $\Gamma$ always contains the members of $\Sigma$ and a special blank symbol (that's not in $\Sigma$).

4. C. $M_2$ accepts the strings in $L(M_1)$, so it halts on them. The other two options are not guaranteed.

5. A. We can build a TM for union which will halt on all inputs, so it is decidable.

6. C. There is no guarantee that $L$ is decidable. If it is not, $\bar{L}$ must be non-recognizable. We know this since $L$ and $\bar{L}$ recognizable would mean $L$ is decidable.

Lecture 2 - Gul

1. B. The machine is in state $q_0$ reading a 0. It moves to $q_1$, writes 1, and moves right.

2. B. $M$ halts (rejecting) on input 1111 and does not halt on 0111.

3. B. There are 3 edges in the machine, all leaving from $q_0$ (one for each possible input symbol). For each of these, there are 3 possible target states, 3 possible symbols to write, and 2 possible directions to move the tape head.

4. C. $M_2$ accepts the strings in $L(M_1)$, so it halts on them. The other two options are not guaranteed.

5. B. We can build a TM for union, so it is recognizable. If $L_1 = L_2 = \Sigma^*$, then $L_1 \cup L_2 = \Sigma^*$ is decidable, but if $L_1 = L_2 = A_{TM}$, then $L_1 \cup L_2 = A_{TM}$ is undecidable.

6. A. $L$ is recognizable since that is weaker than decidable. Decidability is closed under complement (as mentioned in lecture), so $\bar{L}$ is also decidable and thus recognizable.