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, Γ always contains the members of Σ and a special blank symbol (that's not in Σ).
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.