1. **Combinational Circuits**

(a)

decimal	x2	x1	x0	|X|>2
0	0	0	0	0
1	0	0	1	0
2	0	1	0	0
3	0	1	1	1
-4	1	0	0	1
-3	1	0	1	1
-2	1	1	0	0
-1	1	1	1	0

(b) `x2'x1x0 + x2x1'x0' + x2x1'x0`

(c)
```
The circuit does not match the function in parts (a) and (b).

The following input to the circuit will incorrectly result in
  a 0 output: 100.

The following inputs will incorrectly result in a 1 output:
  001 and 010.
```

2. **Regular Expressions, Deterministic Finite State Automata (6 points)**

a) The answer, iii) generates all desired strings and only desired strings.
   i) can generate a string that starts with b.
   ii) cannot generate a single a.
   iv) can generate a string that starts with b.
   v) cannot generate a single a.

b) The answer, i) accepts all desired strings and only desired strings.
   ii) accepts the empty string.
   iii) accepts strings that start with b.

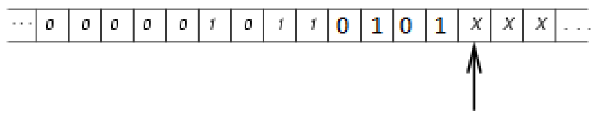
3. **Linked Lists (6 points)**

(a)
- i) returns true
- ii) returns true
- iii) returns false
- iv) returns false

(b) `linky_dink` returns true for a null-terminated linked list. It returns false for a circular linked list, even if the circular part is preceded by a straight path.

(c) N
For a null terminated linked list, b will traverse each node once before the method returns true. For a circular linked list, b which is traveling twice as quickly as a, will catch up to a in a constant number of circuits of the length N list.

4. **Turing Machine (4 points)**

a) 

b) The Turing Machine subtracts 1 from the binary number on the tape.

5. **Data Structures (3 points)**

   (a) Symbol Table
   (b) Binary Search Tree
   (c) Stack

6. **True or False (6 points)** Circle your answer.

T (a) P is the set of search problems solvable in Polynomial time by a deterministic Turing Machine.

F (b) NP is the set of search problems not solvable in Polynomial time by a deterministic Turing Machine.

F (c) For proper encapsulation, instance variables should always be declared public.

F (d) Because the Halting Problem is unsolvable, it is impossible to tell if *your* TSP program for Assignment 6 has an infinite loop.

T (e) A Universal Turing Machine can compute anything that any other Turing Machine could possibly compute.

T (g) If P equals NP, then the Traveling Salesperson Problem can be solved in polynomial time by a deterministic Turing Machine.

F (h) If P does not equal NP, then there is no case of the Traveling Salesperson Problem for which you can find the optimal tour in polynomial time.

F (j) Factoring is known to be in NP but has not been proven to be NP-complete, so the discovery of a polynomial-time algorithm for factoring would mean that P equals NP.

F (k) Factoring is known to be in NP but has not been proven to be NP-complete, so no polynomial-time algorithm for factoring is possible.