MATH 280 Discrete Mathematical Structures Assignment #10 Name _____

The point values for each question is given within []. The total number of points for this assignment is 44.

1. Consider the grammar $\langle T, N, S, P\rangle$, where $T = \{+, *, (,), n\}$, $N = \{S\}$, $S = S$, and P is defined by

$$S \rightarrow S+S \mid S*S \mid (S) \mid n$$

Provide parse trees for the following strings:

[2] (a) $n*(n+n)$

[2] (b) $n*n+n$

2. Consider the grammar $\langle T, N, S, P\rangle$, where $T = \{+, *, (,), n\}$, $N = \{E, T, F\}$, $S = E$, and P is defined by

$$\begin{aligned} E &\rightarrow E+T \mid T \\ T &\rightarrow T*F \mid F \\ F &\rightarrow (E) \mid n \end{aligned}$$

Provide parse trees for the following strings:

[2] (a) $n*(n+n)$

[2] (b) $n*n+n$

3. Let L be generated from the grammar $G = \langle T, N, S, P\rangle$, where:
$T = \{*, /, +, -, (,), 0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$,
$N = \{S, A, B, F, T, I, D\}$,
and P consists of

$$\begin{aligned} &S \rightarrow FA \\ &A \rightarrow +FA \mid -FA \mid \lambda \\ &F \rightarrow TB \\ &B \rightarrow *TB \mid /TB \mid \lambda \\ &T \rightarrow I \mid (S) \\ &I \rightarrow DI \mid D \\ &D \rightarrow 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9 \end{aligned}$$

Provide parse trees for the following strings:

[2] (a) $2+2$

[2] (b) $23*(6-31)+11$

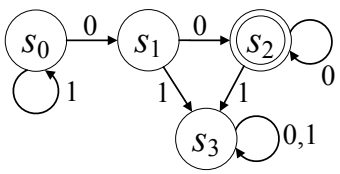
[2] (c) $(20-(10-5))/2$

4. Consider the set of all bitstrings that begin and end with a 1.

[4] (a) Provide a grammar for the language.

[2] (b) Use your grammar to produce a parse tree for the string 10101

[2] 5. Provide a regular expression for the set recognized by the following finite automaton:



6. Provide regular expressions for the following sets:

[2] (a) bitstrings containing an even number of 0s

[2] (b) bitstrings that begin with a 0 and end with 010

[4] 7. Provide a finite automaton that recognizes the set of bitstrings that begin with a 0 and end with 010.

[4] 8. Provide a context-free grammar that generates the language $L = \{ss^R \mid s \in \{0,1\}^*$ and s^R is the reverse of string $s\}$.

9. Consider the regular expression $(1^*0(01)^*)|(00^*)$.

[4] (a) Provide a context-free grammar $G = \langle T, N, S, P \rangle$ for strings represented by the regular expression.

[2] (b) Given your G, draw a parse tree for 00000.

[2] (c) Given your G, draw a parse tree for 00101.

[2] (d) Given your G, draw a parse tree for 1110.

[0] 10. (Optional) Build a Turing machine that recognizes the language $L = \{ss^R \mid s \in \{0,1\}^*$ and s^R is the reverse of string $s\}$. Sample strings in L include λ, 00, 11, 0110, 1001, and 01011010. Use the emulator described in class to test your Turing machine code.