WRIGHT STATE UNIVERSITY
Department of Computer Science
and Engineering

CS 466/666 Spring 2011 Prasad

Final Exam (40 pts)

This is an open textbook and open notes exam.

1 Regular Language Specifications (5 + 5 + 5)

Construct (1) an NFA-λ, (2) a minimal DFA, and (3) a regular grammar for the language corresponding to the regular expression $ab^+ \cup c*$ over the alphabet $\{a, b, c\}$.

2 Language classification (3 + 3)

Consider the context-free language $\mathcal{B} = \{ 0^i 1^j \mid i \neq j \}$.

Is $\mathcal{B}^*$, the Kleene closure of $\mathcal{B}$, regular? Justify your answer.

Give a context-free grammar for $\mathcal{B}^*$.

3 Pumping Lemma (5 + 3 + 2)

Consider the language of bit strings $\mathcal{P} = \{ vw \mid w \in \{0,1\}^* \text{ and } w = \mathsf{reverse}(v) \}$.

Prove that $\mathcal{P}$ is not regular using pumping lemma.

What is $\mathcal{B} \cap \mathcal{P}$?

Is $\mathcal{B} \cap \mathcal{P}$ regular? Justify your answer.

4 Closure Properties (3 + 3 + 3)

Let $\mathcal{FS}$ denote the set of finite languages over $\{\texttt{0,1}\}$, and $\mathcal{CS}$ denote the set of non-regular context-free languages over $\{\texttt{0,1}\}$. Prove or disprove the following claims:

1. The set $\mathcal{CS}$ is closed under set-difference operation.
2. There exists $\mathcal{L} \in \mathcal{FS}$ such that $\mathcal{L}^* \in \mathcal{FS}$.
3. There exist $\mathcal{L}_1, \mathcal{L}_2 \in \mathcal{CS}$ such that $\mathcal{L}_1 \cap \mathcal{L}_2 \in \mathcal{FS}$.