WRIGHT STATE UNIVERSITY
Department of Computer Science
and Engineering

CS 466/666 Summer 2006 Prasad

Final Exam (40 pts)

This is an open book exam. You are allowed to consult only Sudkamp text during the exam.

1 Regular Language Specifications (4 + 6 + 4)

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

2 Language Operations and Type (3 + 4)

Consider the language $\mathcal{B} = \{ a^i b^j \mid i = j \}$.

Is $\overline{\mathcal{B}} = \{a, b\}^* - \mathcal{B}$, the complement of $\mathcal{B}$, regular? Justify your answer.

Give a context-free grammar for $\overline{\mathcal{B}}^*$, the Kleene closure of the complement of $\mathcal{B}$.

3 Pumping Lemma (6 + 4)

Consider the language $\mathcal{P} = \{ wcw \mid w \in \{a, b\}^* \}$.

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

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

4 Closure Properties (3 + 3 + 3)

(**CS466 Only**) Let $\mathcal{FS}$ denote the set of finite languages over {0,1}, and $\mathcal{CS}$ denote the set of non-regular context-free languages over {0,1}. Prove or disprove the following claims:

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

(**CS666 Only**) Let $\mathcal{FKS}$ denote the set of languages over {0,1} that are either finite or whose complement is finite, and $\mathcal{CS}$ denote the set of non-regular context-free languages over {0,1}. Prove or disprove the following claims:

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