浙江大学 2003 —2004 学年第二学期期终考试

《The Theory of Computation》课程试卷

考试时间：__120__分钟　开课学院 计算机学院　专业 ____________

姓名______________ 学号_____________任课教师_______________

题序	1	2	3	4	5	6	7	总分
评分								
评阅人								

1. (20pts, 2 each) Tell whether the statements below are true (T) or false (F).

(1) (　　) Language $\{a^{6n}b^{3m}c^{p+10} : n \geq 0, m \geq 0, p \geq 0,\}$ is regular.

(2) (　　) $\boldsymbol{A}$ and $\boldsymbol{B}$ are two context-free languages, so is $\boldsymbol{A}\oplus\boldsymbol{B}$, where $\boldsymbol{A}\oplus\boldsymbol{B} =(\boldsymbol{A}-\boldsymbol{B})\cup(\boldsymbol{B}-\boldsymbol{A})$.

(3) (　　) Let $\boldsymbol{L}_1, \boldsymbol{L}_2 \ldots \boldsymbol{L}_i \ldots$ are all regular languages, so is $\bigcup_{i=1}^{\infty} L_i$.

(4) (　　) Suppose that $\boldsymbol{L}$ is context-free and $\boldsymbol{R}$ is regular, $\boldsymbol{L}-\boldsymbol{R}$ is context-free language.

(5) (　　) Every regular language can be generated by a context-free grammar.

(6) (　　) Every computable function is primitive recursive.

(7) (　　) Turing Machines with two-way infinite tape accept more languages than standard Turing Machines.

(8) (　　) Every Turing machine semidecides a recursive language.

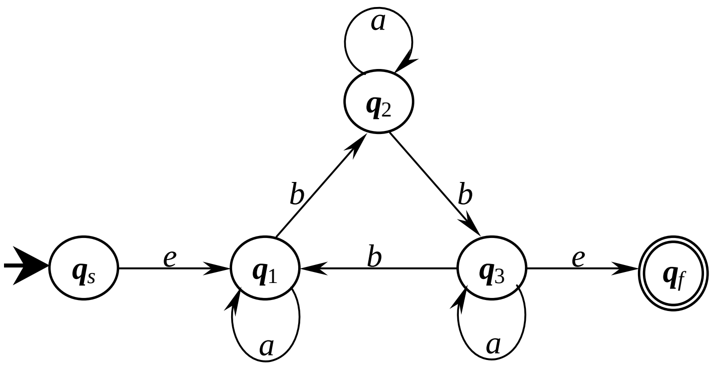
(9) (　　) Suppose $\boldsymbol{M} = (\boldsymbol{K}, \Sigma, \Delta, s, \boldsymbol{F})$ be a nondeterministic finite automaton, then Δ is a function from $\boldsymbol{K}\times\Sigma$ to $\boldsymbol{K}$.

(10)(　　) $\boldsymbol{L}$ is a language, there is a Turing machine $\boldsymbol{M}$ halts on x for every $x\in\boldsymbol{L}$, then $\boldsymbol{L}$ is decidable.

2. Automata and regular expressions:

(1) (8pts) Give a NFA (Nondeterministic Finite Automaton) accepting the language $\boldsymbol{L}=\{x \mid x\in\{a,b\}^*\}$ and *aab* occurs as substring of x at least twice. Draw a state transition diagram of the NFA and simplify as much as possible.

(2) (8pts) Write a regular expression for the language accepted by the following finite automaton:



3. Pushdown Automata (PDA) and Context-free Grammar (CFG):

(1) (8pts) Give a CFG that generates the $\boldsymbol{L}=\{uu^R cvv^R \mid u,v\in\{a,b\}^*\}$.

(2) (8pts) Design a PDA $\boldsymbol{M}=(\boldsymbol{K}, \Sigma, \Gamma, \Delta, s, \boldsymbol{F})$ accepting the language above , where

$\Sigma=\{a, b\}$;

$\boldsymbol{K}=$

$\Gamma=$

$s=$

$\boldsymbol{F}=$

Δ:

(q, α, β)	(q, β)

4. Say whether each of the following languages is regular or not regular (prove your answers):

(1) (8pts) $\boldsymbol{L}_1=\{a^{i \cdot j} : i=4j,\ i,j\in \boldsymbol{N}\}$

(2) (8pts) $\boldsymbol{L}_2=\{w: w\in\{a, b\}^* \text{ and } w\neq w^R \}$

5. (10pts) Consider two deterministic finite automata:

$M_1 = (K_1, \Sigma, \delta_1, q_1, F_1)$ and $M_2 = (K_2, \Sigma, \delta_2, p_1, F_2)$, where

$\Sigma = \{a, b\}$,

$\boldsymbol{K}_1 = \{q_1, q_2\}$ and $\boldsymbol{K}_2 = \{p_1, p_2, p_3\}$,

$\boldsymbol{F}_1 = \{q_2\}$ and $\boldsymbol{F}_2 = \{p_3\}$,

δ_1:

δ_1	a	b
q_1	q_2	q_1
q_2	q_1	q_2

δ_2 :

δ_2	a	b
p_1	p_1	p_3
p_2	p_3	p_2
p_3	p_2	p_1

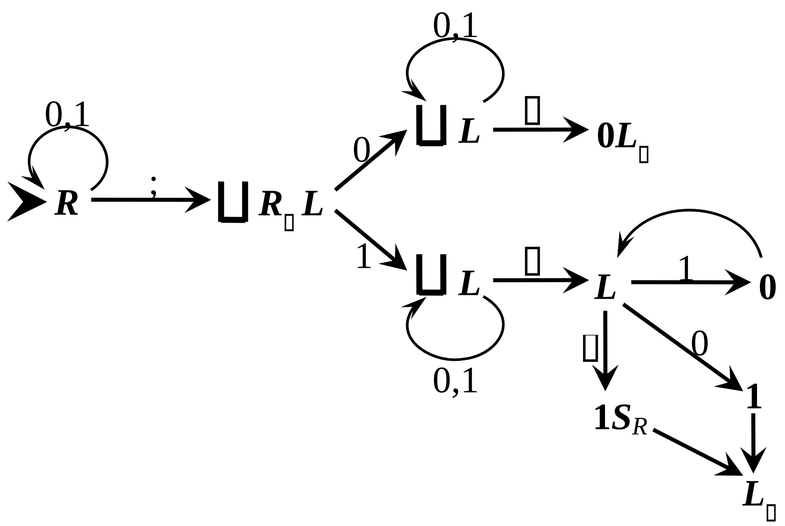
Use the Cartesian product to construct a DFA $\boldsymbol{M}=(\boldsymbol{K}, \Sigma, \delta, s, \boldsymbol{F})$ accepting the union of the two sets accepted by the automata above.

$\boldsymbol{M}$:

δ	a	b

6. (7pts) Give the equivalent primitive recursive function from the predicate $x=y$.

7. Let the following Turing machine $\mathcal{M}$ computes $f(x, y)$, the alphabet is $\Sigma = \{0, 1, \sqcup, ;\}$. The head of $\mathcal{M}$ begins from the most left blank; $\sqcup$ is the symbol of blank; x and y are presented by binary strings respectively and separated with the symbol "$;$".



(1) (7pts) Describe the key configurations when $\mathcal{M}$ started from the configuration $\triangleright\underline{\sqcup}1111;100\sqcup$.

(2) (8pts) Try to give the function $f(x, y)$ that this $\mathcal{M}$ can compute.