COMP2012/G52LAC Languages and Computation

Coursework (20XX/20XX)

Surname: WRITE YOUR SURNAME

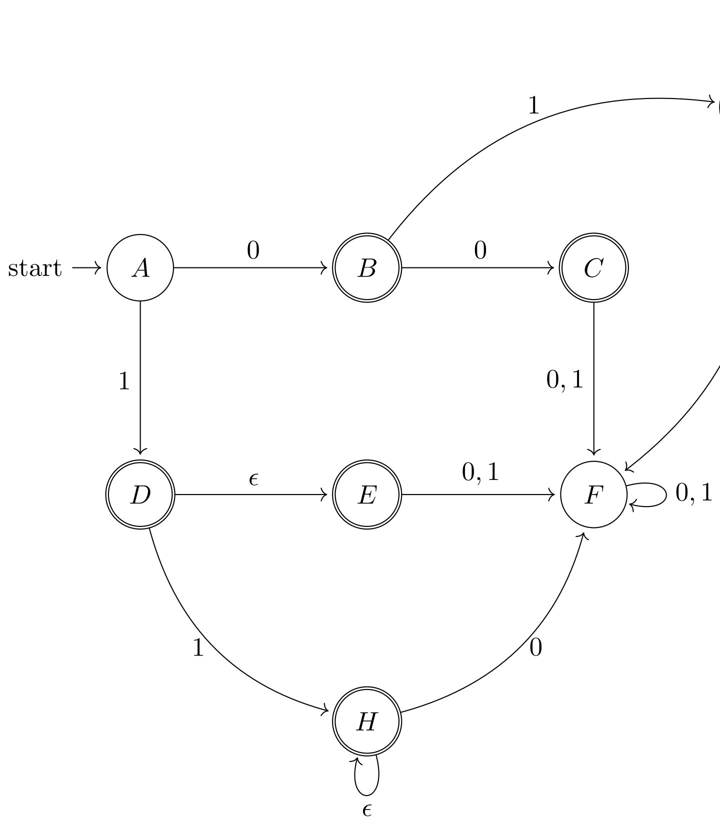
First Name: WRITE YOUR FIRST NAME

ID Number: WRITE YOUR ID NUMBER

Answer Sheet

Question 1

This is how an Automaton is drawn



and a function of transitions is a table of the type

$$\delta: \begin{array}{c|c|c} & 0 & 1 \\ \hline A & A, B & B, C \\ B & \emptyset & B, C \\ C & \emptyset & \emptyset \end{array}$$

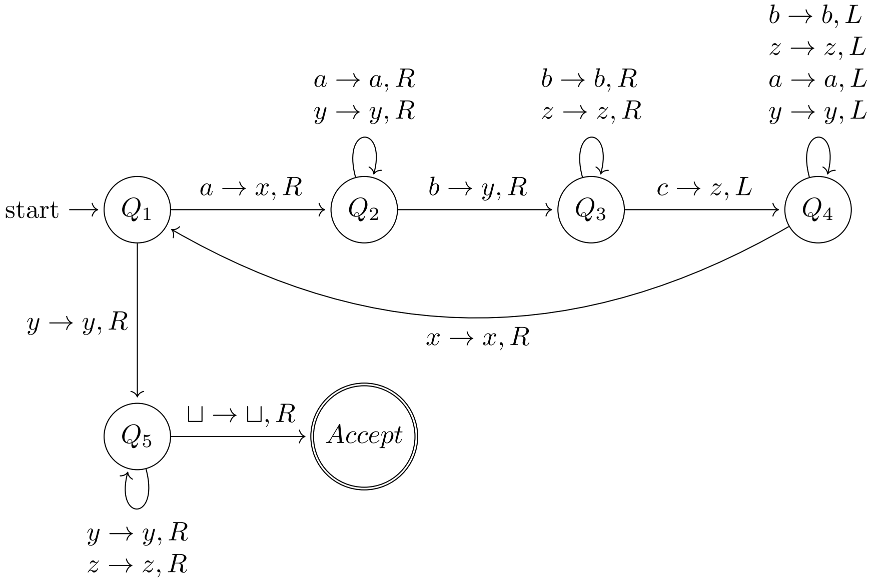
20 marks

Question 2

The table to check the equivalence of two Automata is of the type

	a	b
s_1, q_1	s_1, q_1 **FS, FS**	s_2, q_2 **IS, IS**
s_2, q_2	s_3, q_3 **FS, FS**	s_1, q_1 **IS, IS**
s_3, q_3	s_2, q_4 **IS, IS**	s_3, q_3 **IS, IS**
s_2, q_4	s_3, q_3 **IS, IS**	s_1, q_1 **FS, FS**

A Turing Machine is also drawn as an Automaton



20 marks

Question 3

This is the notation to indicate a Grammar

$$G = (\{S, A, B\}, \{a, b\}, S, P)$$

with production rules P equal to

$$\begin{aligned} &S \to ASA|aB \\ &A \to B|S \\ &B \to b|\epsilon \end{aligned}$$

and when transformations are made, we may indicate them as
step 1: Let us remove the null productions.

step 0 :$W_0 = \{B\}$
step 1 :$W_1 = \{S, A, B\}$
step 2 :$W_2 = \{S, A, B\}$

The set of nullable variables is $W = \{S, A, B\}$.

We may also present the algorithm in the following way

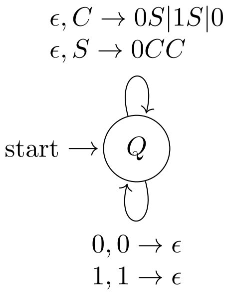
$$\begin{aligned} &\textbf{step 0 :} W_0 = \{B\} \\ &\textbf{step 1 :} W_1 = \{S, A, B\} \\ &\textbf{step 2 :} W_2 = \{S, A, B\} \end{aligned}$$

step 2: Let us remove the unit productions. ...

20 marks

Question 4

A single state Pushdown Automaton is drawn like a Finite Automaton



This is an example of acceptance procedure by $\vdash$ notation

$$
\begin{aligned}
&\epsilon, \mathbf{S} \to \mathbf{0CC} : (Q, 010000, S) \vdash (Q, 010000, 0CC)\\
&\mathbf{0}, \mathbf{0} \to \epsilon : (Q, 010000, 0CC) \vdash (Q, 10000, CC)\\
&\epsilon, \mathbf{C} \to \mathbf{1S} : (Q, 10000, CC) \vdash (Q, 10000, 1SC)\\
&\mathbf{1}, \mathbf{1} \to \epsilon : (Q, 10000, 1SC) \vdash (Q, 0000, SC)\\
&\epsilon, \mathbf{S} \to \mathbf{0CC} : (Q, 0000, SC) \vdash (Q, 0000, 0CCC)\\
&\mathbf{0}, \mathbf{0} \to \epsilon : (Q, 0000, 0CCC) \vdash (Q, 000, CCC)\\
&\epsilon, \mathbf{C} \to \mathbf{0} : (Q, 000, CCC) \vdash (Q, 000, 0CC)\\
&\mathbf{0}, \mathbf{0} \to \epsilon : (Q, 000, 0CC) \vdash (Q, 00, CC)\\
&\epsilon, \mathbf{C} \to \mathbf{0} : (Q, 00, CC) \vdash (Q, 00, 0C)\\
&\mathbf{0}, \mathbf{0} \to \epsilon : (Q, 00, 0C) \vdash (Q, 0, C)\\
&\epsilon, \mathbf{C} \to \mathbf{0} : (Q, 0, C) \vdash (Q, 0, 0)\\
&\mathbf{0}, \mathbf{0} \to \epsilon : (Q, 0, 0) \vdash (Q, \epsilon, \epsilon)
\end{aligned}
$$

20 marks

Question 5

Theoretical questions may need inline equations that is $\sum_{i=1}^{n} x_i$ or a regular expression like $(a+b)^*$. A separate line equation is of the type

$$(a+b)^*$$

If a proof has to be provided then

Proof. Let us consider the following language $L(P) = \{a\}$, and equation

$$L(P^*) = \{\epsilon, a, aa, aaa, \ldots\},$$

which can make a point. Mathematical expressions can be of the type $w \in L(QP^*)$ or something of the type

$$\exists k \in \mathbb{N} \ni' w \in L\left(QP^k\right)$$

or something or the type

$$\forall x \in A \exists! y \in B \ni' (x, y) \in \mathcal{R}$$

with $f : A \to B$ and $\mathcal{R} \subseteq A \times B$.

$\square$

20 marks