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CSC 340

Midterm Exam 1st Term 2022-2023

Department of CS, KSU

Student Name: [redacted] Student [redacted]

Seat number: [redacted] Section: [redacted]

Q1) A) Compare between Java and C++ with respect to

1) Portability (4 grades)

Java is better;

Java translate the code to intermediate language which makes it good respect to Portability

3

where C++?

J?

2) Cost of execution (4 grades)

C++ is better

1- Java is strongly checking language, it checks if array index is out of bond, this increases the cost of execution

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2- C++ traslate the code directly to machine code, while Java translate it to intermediate language then to machine code, this increases the cost of execution

B) Discuss how the Von Neumann architecture influenced the design of programming languages. (4 grades)

Von Neuman architecture works as follows:

1- CPU is seperated from memory

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2- Data and applications are stored in the memory

3- Data piped from CPU to memory

This architecture influnced the programming languages So they are designed respect to this specefications

how?

Q4) Consider the following CFG

```
E --> TE'
E' --> +TE' | ε
T --> FT'
T' --> *FT' | ε
F --> id | (E)
```

A) Find the first and follow set for each symbol in the table below. (10 grades)

	First	Follow
E	{id, (}	{$,)}
E'	{+, ε}	{$,)}
T	{id, (}	{+, $,)}
T'	{*, ε}	{+, $,)}
F	{id, (}	{*, +, $,)}

10

B) Draw the corresponding LL(1) table. (4 grades)

	+	*	id	(	)	$
E			TE'	TE'		
E'	+TE'				ε	ε
T			FT'	FT'		
T'	ε	*FT'			ε	ε
F			id	(E)		

4

C) What is the shortest string that does not belong to the language of the grammar? (2 grades)

E → TE' → FT'E' → idT'E' → idE' → id

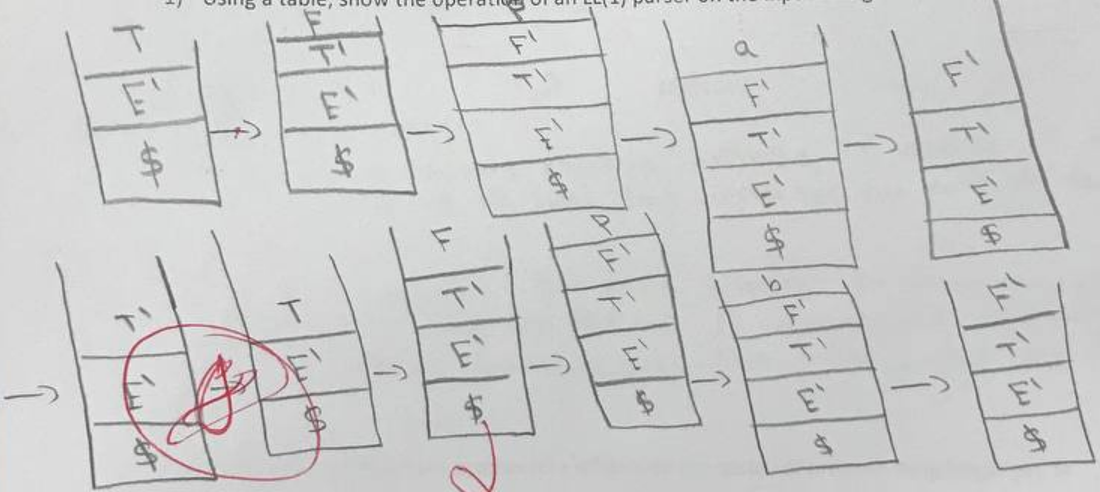
Shortest string is "id"

D) Consider the following LL(1) parsing table for the grammar.

	(	)	a	b	ep	+	*	$
E	TE'		TE'	TE'	TE'			
E'		ϵ				$+E$		ϵ
T	FT'		FT'	FT'	FT'			
T'	T	ϵ	T	T	T	ϵ		ϵ
F	PF'		PF'	PF'	PF'			
F'	ϵ	ϵ	ϵ	ϵ	ϵ	ϵ	$*F'$	ϵ
P	(E)		a	b	ep			

E → TE'
E' → +E
T → FT'
T' → T
F → *F'
P → (E) | a | b

1) Using a table, show the operation of an LL(1) parser on the input string ab*. (5 grades)



and will repeat ...

2) What is the follow set of E' ? (2 grades)

follow(E') = {), $ }

2

Q2) Describe each of the following languages, defined over the alphabet S={a,b}, using a regular expression, if you think it is a regular language, or using a CFG, if you think it is not.

aab
aba
baa

A) the language of all strings where the number of a's is twice the number of b's. (4 grades)

$S \rightarrow aSaSbS \mid aSbSaS \mid bSaSaS \mid \varepsilon$

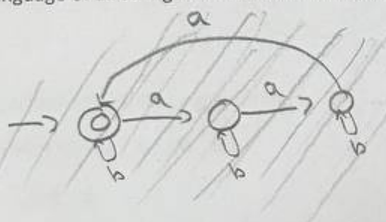
4

/

B) the language of all strings defined over the alphabet S={a,b}, where the number of a's is divisible (4 grades) by 3

baaa
abaa
aaba
aaab

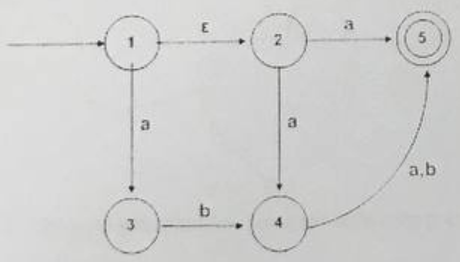
4



$(b^* a b^* a b^* a b^*)^*$

✓

Q3) Consider the following NFA



5
4,5
5

A) Describe the language recognized by the above NFA using a regular expression. (2 grades)

2

$[a] + [a(a+b)] + [ab(a+b)]$

✓

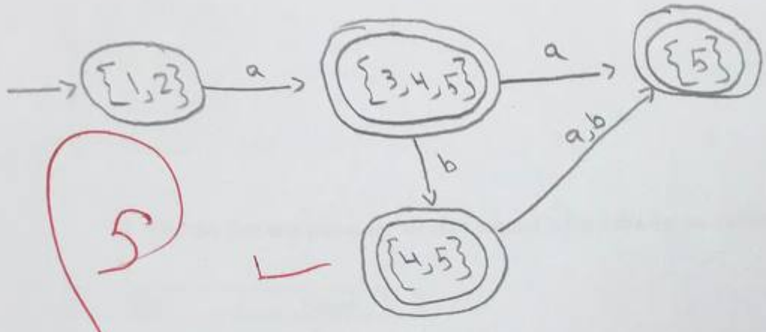
B) Considering a worst-case scenario, how many states would the equivalent DFA of an NFA with 5 states consists of? (2 grades)

$2^N - 1 = 2^5 - 1 = 31$

2

✓

C) Convert the above NFA into an equivalent DFA? (5 grades)



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Q4) a) Left factor the following grammar: (4 grades)

E → int | int + E | int - E | int - (E)

E → int X

X → +E | -E | -(E) | ε

2

b) Eliminate left-recursion from the following grammar: (4 grades)

A → A + B | B

B → int | (A)

A → BX

X → +BX | ε

B → int | (A)

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