Statement to be included in assessments and assignments (as approved by the Registrar, Vice-Principal Academic and DESA): *"The University of Pretoria commits itself to produce academic work of integrity. I affirm that I am aware of and have read the Rules and Policies of the University, more specifically the Disciplinary Procedure and the Tests and Examinations Rules, which prohibit any unethical, dishonest or improper conduct during tests, assignments, examinations and/or any other forms of assessment. I am aware that no student or any other person may assist or attempt to assist another student, or obtain help, or attempt to obtain help from another student or any other person during tests, assessments, assignments, examinations and/or any other forms of assessment."*

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COS341 Compiler Construction
EO1 ("Semester Test")

Department of Computer Science

University of Pretoria

1st of June, 2020: **17h30-20h00**

Instructions!

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- **Solve all problems** with help of your textbook!
- The Total Value of this EO1 Test is ***15 Points***:

  ***15 Test Points* = 30 Semester Marks**.
- Provide your solutions **as PDF**:
  - Word.DOC files will not be accepted under any circumstances!
- **Upload** your solutions to the COS341 web page:
  - EMail submissions will not be accepted under any circumstances!
- Submit your solutions **timely before deadline**:
  - Belated submissions will not be accepted under any circumstances!

Question 1 [*4 Points*]

- Given are the two **regular expressions**

  RE1 := **(a*b*)***

  RE2 := **(a*|b*)***

- **Prove** that ***L*(RE1) = *L*(RE2)**,

  via their **NFA**, **DFA**, and **M**inimized **DFA**!

  – Construct the automata according to the techniques shown in Chapter #1.

  – **Show the steps** of the development:

  do not merely present the final result.

Question 2 [*3 Points*]

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- Given is the following grammar **G**:

  Prog → **action**

  Prog → **if** Cond **then** Prog

  Prog → **if** Cond **then** Prog **else** Prog

  Cond → **bool**

- **Prove** constructively that **G** *is ambiguous.*
  - **Hint**: utilize the **Definition** of "ambiguous"

Question 3 [*5 Points*]

- Given is the following grammar **G**:

  Prog → Assign
  Prog → Assign Prog
  Assign → Var **=** Var **;**
  Assign → Var **=** Var Op Var **;**
  Op → **+**
  Op → *****
  Var → **a**
  Var → **b**

- **Analyse and prove** whether (or not) **G** is **LL(1)**.
  - **Show the steps of your analysis**:
    do not merely present the final result.

Question 4 [*3 Points*]

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- The following recursive **function-program** conforms to **Grammar 4.1** of our book:

```
int F(int x) =
    if 10<x
    then 0 // comment: return this value
    else let y=x+x in 1+F(y) // comment: return this result
```

Advice:
To make the task somewhat easier, **we IGNORE** the matter with **the main function** that is described in Sub-Section **4.3.3** and Figure **4.4**, and **we ONLY work with the Symbol-Table for variables (*vtable*)**

- **For start** we already bind the formal input parameter **x** to the concrete input value **4**:
- On the basis of this start value, **show the run** of the **interpreter step by step**, until the final result emerges.
  - Use the interpretation **rules and procedures** given in **Figures 4.2–4.3** of the book.
  - Thereby also show the updates in the symbol ***v****table* which the interpreter accesses while it is running: draw pictures of the symbol ***v****table*.
  - Show all recursive self-calls of the interpreter: do not merely present the final result.

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END

There are no further Questions.

Double-check before submission that your work shows:

your **First Name** (given name)

your **Last Name** (family name)

your **Student ID** (number)