FINAL EXAM (OUT OF 100%)

SEMANTICS OF PROGRAMMING LANGUAGES

INSTRUCTIONS: ATTEMPT ALL THE QUESTIONS

Question 1. (10 Marks)

Briefly discuss what you understand by the following terms:

a. Semantics
b. Inheritance
c. Stack and heap
d. Dynamic binding
e. Type checking

Question 2. (20 Marks)

Software engineers and IT managers need to know the strengths and weaknesses of programming languages. Name five ways in which one can evaluate programming languages.

Question 3. (10 Marks)

Discuss the two categories of semantics.

Question 4. (20 Marks)

Discuss the difference between Functional Programming language and logic programming languages

Question 5. (20 Marks)

a) Considering a 0/1 knapsack problem, explain the application of Dynamic programming algorithm and use it to find an optimal solution.
b) Explain FIVE criteria which every Algorithm should satisfy.

Question 6. (20 Marks) *slide 51 is provided at the bottom of this paper*

What is wrong with the following suggestion?

"The rule ($\Downarrow_{\text{letrec}}$) on Slide 51 can be simplified to

$$\frac{\langle M_2[(\textbf{letrec } x = M_1 \textbf{ in } x)/x], s\rangle \Downarrow \langle V, s'\rangle}{\langle \textbf{letrec } x = M_1 \textbf{ in } M_2, s\rangle \Downarrow \langle V, s'\rangle}$$

because in the body of the **letrec**-expression, x is defined to be M_1 so we can use **letrec** $x = M_1$ **in** x instead of **letrec** $x = M_1$ **in** M_1."

[Hint: consider **letrec** $x = 0$ **in** x.]

LFP$^+$ evaluation relation

is given by the evaluation rules for call-by-name LFP plus:

$$(\Downarrow_{\mathrm{letrec}}) \quad \frac{\langle M_2[(\mathbf{letrec}\ x = M_1\ \mathbf{in}\ M_1)/x], s\rangle \Downarrow \langle V, s'\rangle}{\langle \mathbf{letrec}\ x = M_1\ \mathbf{in}\ M_2, s\rangle \Downarrow \langle V, s'\rangle}$$