

UCT CSC305 2004 :: Compilers :: Exam [25 marks]

Question 1 : Semantic Analysis [5]

1. Displays are an alternative to static chains for non-local name resolution. Explain how displays are modified when symbols are declared and scopes are opened and closed. [2]
2. Briefly discuss 3 cases where main memory (stack frame) is needed during parameter passing, as opposed to using just registers. [3]

Question 2 : Code Generation [10]

1. What is a basic block? How can the selection of traces improve on efficiency of generated code? [3]
2. In the context of instruction selection by tiling, what is the difference between an optimal and optimum algorithm? [2]
3. Explain how the maximal munch algorithm works. [4]
4. Is the maximal munch algorithm optimal or optimum? [1]

Question 3 : Register Allocation [10]

1. Use the iterative liveness analysis algorithm to calculate the live-in and live-out sets for each of the following statements in a program, with the initial and final live sets indicated - assume live-in (succ (a=5)) = {c}.

[live-in: a]

b = 23

c = a + b

b = 12

a = 5

[live-out: c]

Hint: The relevant formula are:

$$out[n] = \bigcup_{s \in succ[n]} in[s]$$

$$in[n] = use[n] \cup (out[n] - def[n])$$

2. Consider the following graph with nodes indicating temporaries and arcs indicating interference. Apply a register colouring algorithm to 3-colour the graph. Assume that R1 is a precoloured node and use George's criterion for conservative coalescing. Clearly show all steps in the algorithm and the final register allocation (R1, R2, R3) to temporaries. [5]



