CPSC 510: Final Exam 1ˢᵗ Semester

Robin Cockett

December 7, 2007

This is a take home exam and is worth 45% of the first semester.

PART I: Technical material

1. (15 marks) Describe the steps required to turn a CIRL program into machine code. Given the following CIRL program illustrate the steps to convert it to code.

```
var a[200],b,c : int
var p: bool

function f( var index :ptr(int) var y, step:int ):bool
  [ { s := 0; r:= 0; step:= mem(fp(step)); y:= mem(fp(y));
        index:= mem(fp(index));
      t := 2 * step; p := y; z:= y * y;
      if p*t <z then
      {while s<25
         { i := s * (2 * step);
           s := s+1;
           u := p;
           r := r + mem(index \ (i+u*t));
         };
      }
      else { r:= z-y*t; };
    } r < 1000
  ]



  { a := mem(addr(a));
    b := mem(addr(b));
    c := mem(addr(c));
    q := mem(addr(p));
    if { v := f(a,b,c) || f(a,c,b); } v && mem(addr(p))
    then { s := c; }
    else { s := 1; };
  } s* mem(mem(addr(a))\ mem(addr(b)))
```

2. (10 marks) In the above CIRL program turn the function body into a flowgraph and convert it into static single assignment form and do a register allocation on this.

3. (10 marks) Convert the above function into a FLOEY program and use the reduction algorithm and induction variables to optimize the program. Compare the result to that of the previous questions!

PART II

(10 marks)

   The aim of this section is for you to develop an outline of the project you will undertake next semester. There are various ingredient that must be present:

Description: Provide a short description of the project and its goals. If you intend to implement a programming language give an overview of the language and indicate what you intend to achieve in the compiler (e.g. what optimizations) and what the target machine code will be. If you intend to concentrate on some aspect of the compilation process describe it, describe the form of input you intend to use and provide an example of what you wish to achieve.

Resources: Collect references (links) to the software tools you intend to use, any relevent documentation, any reference books you might use, any journal or conference articles you intend to use. I am expecting something in each category: having these resources at you finger tips will be useful as the project proceeds.

Milestones: You will be expected to provide four milestone presentations during the semester *and* a project initiation presentation (supported by this document. You should map out the project into approximately 3 week chunks (e.g. front-end, semantic checking, optimization, code-generation) and indicate the stage you intend to have reached at each milestone. BE REALISTIC!!

Deliverables: You must indicate what you intend to deliver at the end of the project. This must include:

  - A project website. This must be set up for the initial presentation and should be kept current throughout the semester (especially at each milestone). All the deliverables should eventually be linked into this.

  - Project documentation. This should be provided linked to the website and should include a description of problems encountered, of techniques used to solve these problems, of any code which is produced, and – most importantly – examples to illustrate these points.

  - Code: with a clear description of how to run it and examples on which to run it!