CS328, Fall 2002, Test 1

Time 75min. Open notes/books. Use extra paper as needed, but make sure to identify each answer. 5 questions, all equal.

YOU MUST RETURN THIS PAGE. NAME_____

1 You have a compiler for C which runs slow and also generates targets which are slow due to bad optimization. You also have a source for the compiler, the source is in C. Two areas to improve are: i) improve compilation speed ii) improve speed of execution of targets.
a) Can you improve i) and/or ii) through some kind of bootstrapping of the existing code? Show how or say why not.
b) Now suppose you can borrow, for a day, a C compiler, just the executable, and this compiler generates faster optimized targets. Can you use this compiler to improve i) and/or ii)? If no, why not? If yes, show how.
To illustrate improvements, use an example of a program Prg written in C, and for i) show fast compilation and for ii) show fast execution of the program.

2 For years a 2-stage Pascal compiler was used, Pascal->Pcode compiler and Pcode interpreter.
a) Suppose you have Pascal program Prg. Show how execution would be accomplished
b) Discuss primary advantages of such a 2-stage compiler

3 Assume machine code with opcodes: ADD=00, LOAD=10, SUB=20, STOP=30, BR=40, STORE=50, READ=60

```
    READ X
    SUB 10
    ADD 20
    STORE X
    BR EXIT
    ADD X
EXIT:
    STORE X
    STOP
X   100
```

STOP takes no arguments and uses 1 byte, other instructions take 1 byte for opcode and 2 bytes per argument. Data storage is 2 bytes and it is allocated in the same segment exactly where it appears in the program except all data must be even aligned on even offset byte boundary. Immediate values are placed in a literal pool, 1 byte each, no alignment, and the pool is allocated at the end of the target.
Show the resulting machine code in relocatable format.

4 Suppose we deal with the binary alphabet {0,1}. Tokens come in separated by WS. We want to recognize tokens of the form(0 | 1) 10*, and report two different tokens, those starting with 0 and those starting with 1. Design a DFA.

5 There is a game where you throw 2 dice. Even total pays you $1. But two 1s pays $5 instead. Anything else and you have to pay $1.
a) If you could play the game forever, what would happened as far as money?
b) Design a DFA to play the game. What is alphabet, what are tokens, and then show the graph DFA.