Lecture 7

Loading

CS 241: Foundations of Sequential Programs
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Correctness

- thinking reasonably
- remembering memory
- running times do matter

Pictorial Review: CPU and RAM

Pictorial Review: Assembler

The magic of loaders

Loader pseudocode

```
loop
    decide which program to run
    figure out length of the program (n)
    find n words of storage at address α
    read program into memory at α
    set up program (e.g., twoints)
    put α into a register (say $29)
    jalr $29
endloop
```

Chickens and eggs

What is the size of the program?

Example Program

```
lis $3
.word fortytwo
lw $3, 0($3)
jr $31
fortytwo:
  .word 42
```

Why does this work? When does it not work?

Example Program Again

```
lis $3
.word fortytwo
lw $3, 0($3)
jr $31
fortytwo:
  .word 42
```

What breaks? How can we fix it?

Solving this problem

MERL

MERL Format

- Header cookie
- Length of entire .merl file
- Length of just MIPS program
- Program code
- Notes of what to change

See full description on CS241 webpage.

Relocating Loader Pseudocode

```
read header
α = findFreeRAM(codeLength)
for each instruction
  MEM[α+i] = instruction
for each relocation entry
  MEM[α+location] += α
```