Daniel Leeds, 6.004 R13, April 5, 2006; Lecture and Tutorial Problems Excerpts

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Stacks

Conventions:

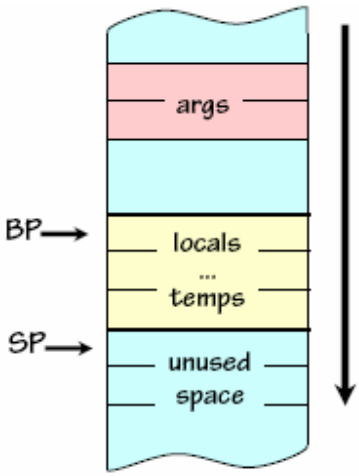
- Dedicate a register for the Stack Point (SP), R29
- Builds UP (towards higher addresses) on push
- SP points to first UNUSED location

Management Macros

- PUSH(RX): push Reg[x] onto stack
  - ADDC(R29,4,R29)
  - ST(RX,-4,R29)
- POP(RX): pop the value on the top of the stack into Reg[x]
  - LD(R29,-4,RX)
  - ADDC(R29,-4,R29)
- ALLOCATE(k): reserve k words of stack
  - ADDC(R29,4*k,R29)
- DEALLOCATE(k): release k words of stack
  - SUBC(R29,4*k,R29)

Procedure Linkage Contract:

- The CALLER will:
  - Push args onto stack in reverse order
  - Branch to callee, putting return address into LP
  - Remove args from stack on return
- The CALLEE will:
  - Perform promised computation, leaving result in R0
  - Branch to return address
  - Leave stacked data intact, including stacked args
  - Leave regs (except R0) unchanged



Special Registers

- R27 = BP Base ptr points into stack to local variables of callee
- R28 = LP Linkage ptr is return address to caller
- R29 = SP Stack ptr points to first unused word

(and we already know)

- R31 = 0 Fixed to zero

Problem 1:

```
gcd:
     PUSH (LP)
     PUSH (BP)
     MOVE (SP, SP)
     PUSH (R1)
     PUSH (R2)
     LD (BP, -12, R0)
     LD (BP, -16, R1)
     CMPEQ (R0, R1, R2)
     BT (R2, L1)
     CMPLE (R0, R1, R2)
     BT (R2, L2)
     PUSH (R1)
     SUB (R0, R1, R2)
     PUSH (R2)
     BR (gcd, LP)
     DEALLOCATE (2)
     BR (L1)
L2:
     SUB (R1, R0, R2)
     PUSH (R2)
     PUSH (R0)
     BR (gcd, LP)
     DEALLOCATE (2)
L1:
     POP (R2)
     POP (R1)
     MOVE (BP, SP)
     POP (BP)
     POP (LP)
     JMP (LP)
```

```
???
0x00000594
0x00001234
0x00000046
0x0000002A
0x0000000E
0x0000001C
0x00000594
0x0000124C
0x0000000E
```