

21 March 2001

Important announcements

Upcoming Quiz – 9 April

[Homework](#)

[Labs](#)

Subroutines

`X = sqrt(Y) ;`

How do you get to `sqrt`?

How do you return to caller?

How do you pass the argument `Y`?

How do you retrieve the returned value?

Entering the subroutine in LC-2

Requires an instruction to branch and remember the return

JSR – jumps to subroutine and saves PC in R7

```
JSR      sqrt
```

JSRR – jumps to subroutine via register and saves PC in R7

```
LD       R5, Asqrt
```

```
JSRR    R5, #0
```

```
.....
```

```
Asqrt   .FILL   sqrt
```

JSR/JMP and JSRR/JMPR share the same opcode

If bit 11 is 1, the subroutine jumps are used

Returning from the subroutine in LC-2

Branch to value saved in R7

Calling conventions

Where are arguments located?

How are values returned?

What registers can be used without saving?

Passing arguments in LC-2

Could pass them in registers, if not too many

Alpha uses R16 to R12

Could use an *activation record* – more in chapters 10 and 14

Alpha uses the stack if more than 6 arguments

Activation format in the LC-2

R6 points to bottom (*lowest address*) of activation record

Return value	Stored by callee
Return address	Saved in R7 by caller, stored by callee
Dynamic link	<i>Wait until chapter 14</i>
Passed arguments	Stored by caller
Local variables	<i>Wait until chapter 14</i>

Returning values in the LC-2

Registers (R0)

Example 1

Function to multiply R0 by 10

Example 2

Write function `prntint`

Single integer argument passed in R0

Writes R0 in decimal to the CRT

Returns in R0 the number of characters printed

Using function `div10`

Receives a dividend in R0

Returns quotient in R1

Returns remainder in R2