EEL 4744

Today's Menu

• Parameter Passing Methods

> Use the Internal Register(s)

> Use the Program Memory Space

> Use the Stack

> Use global memory

Look into my ...

See examples on
web-site: `ParamPassing*.asm` and
see "*Parameter Passing Methods*" in
Software and Documentation"

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Parameter Passing Methods

• How do you pass parameter(s) (data or pointer) between the subroutines (or interrupts) and the main routine or other subroutines?

> **Use the Internal Register(s)**
  – Pass the parameter(s) (data or pointer) in the internal registers.

> **Use the Program Memory Space**
  – Pass the parameter(s) (data or pointer) immediately after the call instruction, i.e. in the program memory space.

> **Use the Stack**
  – Pass the parameter(s) (data or pointer) on the stack prior to the call.

Aside: After a pull, what exists above the stack pointer?

Depends! **No** guarantees!

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Passing Data in Internal Registers

- **Use the Internal Register(s):** Pass the parameter *data* in the internal registers.
  - >Problem: Finds the Average of Two Numbers
  - >Solution: See solution program

`ParamPassing1a.asm`

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Passing Pointers to Data in Internal Registers (Parameters in Program Memory)

- **Use the Internal Register(s):** Pass the parameter *address (pointer)* in the internal registers. The parameters are in **program** memory.
  - >Problem: Finds the Average of Two Numbers
  - >Solution: See solution program

`ParamPassing1b.asm`

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Passing Pointers to Data in Internal Registers (Parameters in Data Memory)

- **Use the Internal Register(s):** Pass the parameter *address (pointer)* in the internal registers. The parameters are in **data** memory.
    - >Problem: Finds the Average of Two Numbers
    - >Solution: See solution program

`ParamPassing1c.asm`

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Passing Data in Program Memory

- **Use the Program Memory Space**: Pass the parameter *data* immediately after the call instruction, *i.e.* in the program memory space. (This requires that the parameter(s) **be fixed** at assemble time).
    - >Problem: Finds the Average of Two Numbers
    - >Solution: See solution program
    - >Since data follows the call, the return address pushed on the top of the stack by the subroutine call **must be corrected** before returning from the subroutine
    - >Notice that the return address is both the return location and the location of the data

`ParamPassing2a.asm`

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Passing Data in Program Memory

>Since data follows the call, the return address pushed on the top of the stack by the subroutine call **must be corrected** before returning from the subroutine

>Notice that the return address is both the return location and the location of the data

>XMEGA chip addresses are 3 bytes
  – The data is copied to another register to protect the return address from changes

```
pop    R18
sts    CPU_RAMPX, R18
pop    XH
pop    XL
movw Z, X
```

ParamPassing2a.asm

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Passing Data in Program Memory

>Since the address of the data is in program memory, it must be shifted left

```
lsl    ZH
lsl    ZL
ldi    R16, 0x00
adc    ZH, R0
```

ParamPassing2a.asm

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Passing Pointers to Data in Program Memory

- **Use the Program Memory Space**: Pass the parameter *address (pointer)* immediately after the call instruction.
    - >Similar to ParamPassing2a.asm except now a pointer to the data is passed (instead of the data itself), so that the data does not have to be know at assemble time.
    - >Does require a second process of shifting the address
    - >Problem: Finds the Average of Two Numbers
    - >Solution: See solution program

`ParamPassing2b.asm`

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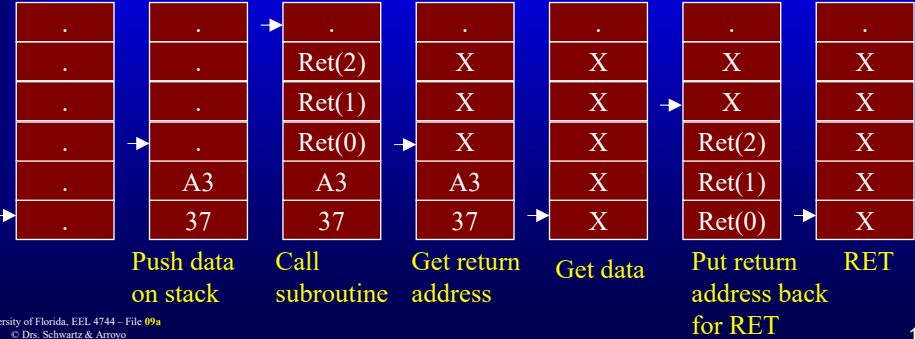© Drs. Schwartz & Arroyo

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Passing Data on the Stack

- **Use the Stack**: Pass the parameter *data* on the stack prior to the call.
    - >Problem: Finds the Average of Two Numbers
    - >Solution: See solution program

`ParamPassing3A.asm`

.	.	.	.	.	.	.
.	.	Ret(2)	X	X	X	X
.	.	Ret(1)	X	X	X	X
.	.	Ret(0)	X	X	Ret(2)	X
.	A3	A3	A3	X	Ret(1)	X
.	37	37	37	X	Ret(0)	X
	Push data on stack	Call subroutine	Get return address	Get data	Put return address back for RET	RET

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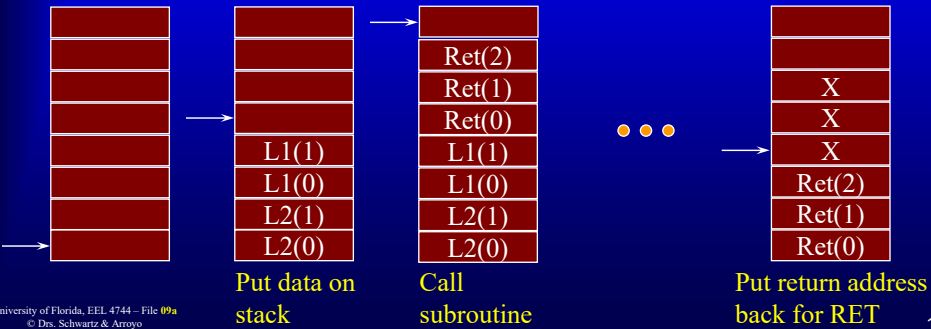© Drs. Schwartz & Arroyo

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Passing Pointers to Data on the Stack

- **Use the Stack**: Pass the parameter *address (pointer)* on the stack prior to the call.
  - >Problem: Finds the Average of Two Numbers
  - >Solution: See solution program

ParamPassing3b.asm

		Ret(2)			
		Ret(1)			X
		Ret(0)			X
	L1(1)	L1(1)			X
	L1(0)	L1(0)			Ret(2)
	L2(1)	L2(1)			Ret(1)
	L2(0)	L2(0)			Ret(0)

Put data on stack / Call subroutine / Put return address back for RET

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Passing Data in Global Data Memory

- **Use Global Memory**: The most common way to pass data by neophyte assembly language programmers is by using *global data memory*.
  - >Problem: Finds the Average of Two Numbers
  - >Solution: See solution program

ParamPassing4.asm

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Passing Data in Constants

• **Use Constants**: Pass the parameters as constants
  >Problem: Finds the Average of Two Numbers
  >Solution: See solution program

`ParamPassing5.asm`

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The End!

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