Computer Organization ALA

Semester 4

CSE A

Topic: PROGRAM CONTROL

Introduction to the content

Instructions are always stored in successive memory locations.

Each time an instruction is fetched from memory, the program counter is incremented so that it contains the address of the next instruction in sequence.

Specifically, program control instruction when executed may change the address value in program counter and cause the flow of control to be altered.

Topics in Program Control

- Status bit conditions
- Conditional Branch Instructions
- Subroutine Call and Return
- Program interrupt & types

status bit conditions

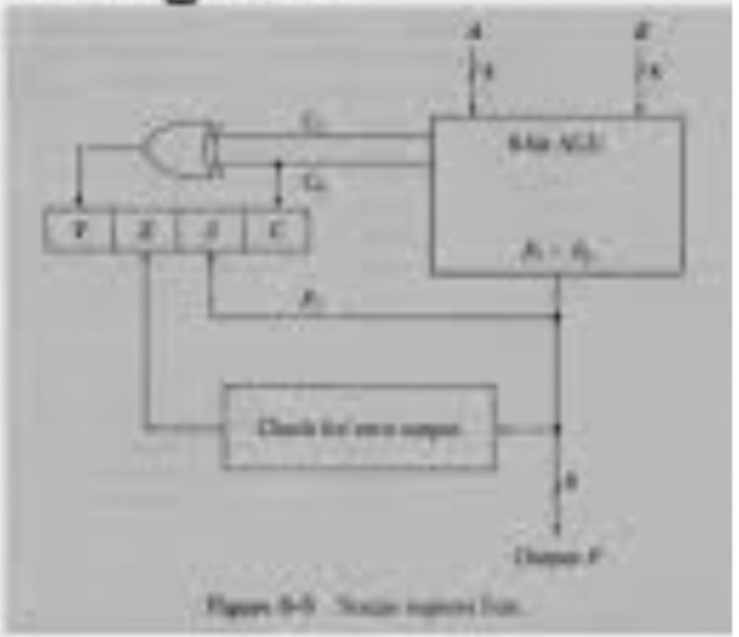
The status register is a hardware register that contains information about the state of the processor..

The status register lets an instruction take action contingent on the outcome of a previous instruction.

The status register in a traditional processor design includes at least three central flags: Zero, Carry, and Overflow, which are set or cleared automatically as effects of arithmetic and bit manipulation operations.

4-bit status register

- Bit C (*carry*) : *set to 1 if the end carry C8 is 1*
- Bit S (*sign*) : *set to 1 if F7 is 1*
- Bit Z (*zero*) : *set to 1 if the output of the ALU contains all 0's*
- Bit V (*overflow*) : *set to 1 if the exclusive-OR of the last two carries (C8 and C7) is*equal to 1



What are conditional branch instructions?

The term branching can be used when referring to programs in high level languages as well as program written in machine code or assembly language.

In high-level programming languages, branches usually take the form of conditional statements of various forms that encapsulate the instruction sequence that will be executed if the conditions are satisfied..

Machine level branch instructions are sometimes called jump instructions.

Subroutine Call

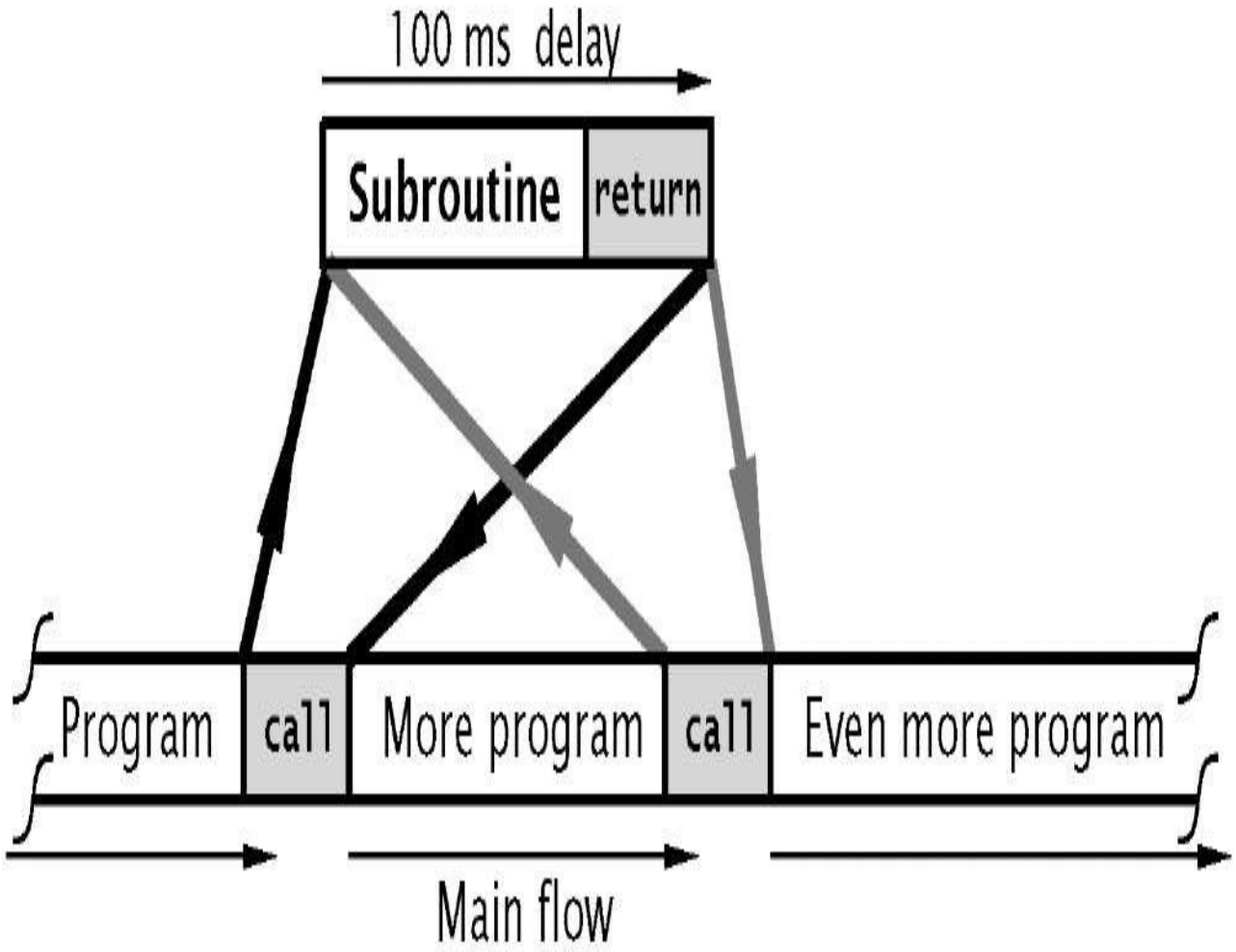
- A subroutine is a self-contained sequence of instructions that perform a given computational task.

During the execution of a program , a subroutine may be called to perform its function many times at various points.

Subroutine Return

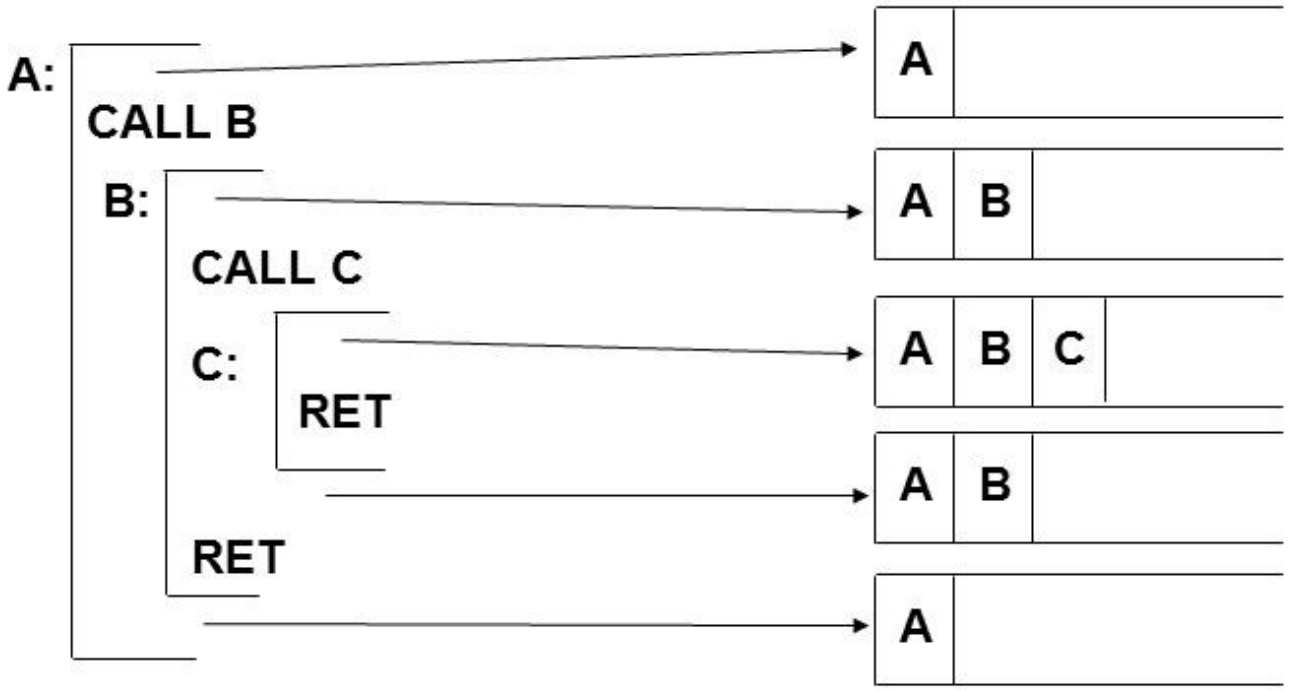
The subroutine may return a computed value to its caller (its return value), or provide various result values or output parameters.

A subroutine call may also have side effects such as modifying data structures in a computer memory, reading from or writing to a peripheral device, creating a file, halting the program or the machine, or even delaying the program's execution for a specified timeout


100 ms delay
Subroutine
return
Program
call
More program
call
Even more program
Main flow

Subroutine Calls

Stacking of Subroutine Calls & Returns and Environments:



Program Interrupt

When a Process is executed by the CPU and when a user Request for another Process then this will create disturbance for the Running Process. This is also called as the **Interrupt**.

Interrupts can be generated by User, Some Error Conditions and also by Software's and the hardware's. So that When an interrupt has Occurred then the CPU will handle by using the Fetch, decode and Execute Operations.

Interrupts allow the operating system to take notice of an external event, such as a mouse click.

Supervisor Mode

The execution mode on some processors which enables execution of all instructions, including privileged instructions.

It may also give access to a different address space, to memory management hardware and to other peripherals.

This is the mode in which the operating system usually runs.

In computer terms, supervisor mode is a hardware-mediated flag which can be changed by code running in system-level software.

Types of program interrupt

- External
- Internal
- Software

External Interrupts

They come from I/O devices, from a timing device, from a circuit monitoring the power supply, or from any other external source.

Timeout interrupt may result from a program that is an endless loop and thus exceeded its time allocation.

Internal Interrupts

They arise from illegal use of an instruction or date. They are also called TRAPS.

These erros occur due as a result of premature termination of the instruction execution.

The service program that processes the internal interrupt determines the corrective measure to be taken.

Software interrupts

It is a special instruction that behaves like an interrupt rather than a subroutine call.

It can be used by the programmer to initiate an interrupt procedure at any desired point in the program.

It is mainly used in supervisor mode.

THANKYOU