**Branching**

Unstructured gotos

that has a complex and tangled [control structure](http://en.wikipedia.org/wiki/Control_structure) also known as spaghetti code

Structured unconditional branches (break and continue)

What is a multilevel return?

*Multilevel returns:* Returns and (local) gotos allow control to return from the

current subroutine. On occasion it maymake sense to return from a *surround***EXAMPLE**

6.41 *ing* routine. Imagine, for example, that we are searching for an item matching

Escaping a nested

subroutine

some desired pattern with a collection of files. The search routine might invoke

several nested routines, or a single routine multiple times, once for each

place in which to search. In such a situation certain historic languages, including

Algol 60, PL/I, and Pascal, permit a goto to branch to a lexically visible

label *outside* the current subroutine:

**Selection**

Matching else ambiguity

Short circuited selection

**hort-circuit evaluation**, **minimal evaluation**, or [**McCarthy**](http://en.wikipedia.org/wiki/John_McCarthy_(computer_scientist))**evaluation** denotes the semantics of some [Boolean operators](http://en.wikipedia.org/wiki/Logical_connective) in some [programming languages](http://en.wikipedia.org/wiki/Programming_language) in which the second argument is executed or evaluated only if the first argument does not suffice to determine the value of the expression:

Case

the case statement is meant to *compute* an address to which it jumps in a single

instruction

and switch statements,

types allowed,

values are discrete: integers, characters, enumerations,

and subranges of the same. C# allows strings as well.

default case, fall through, implementation strategies, missing values

**Topics**

**Branching**

Multilevel returns

Unwinding

In the event of a nonlocal goto, the language implementation must guarantee

to repair the run-time stack of subroutine call information. This repair

operation is known as *unwinding*.

Exceptions

Conditions

that require a program to “back out” are usually called *exceptions*.

Continuations - save a program address and a closure for that address

**Sequencing**

What is sequencing?

It is the principal

means of controlling the order in which side effects (e.g., assignments) occur:

when one statement follows another in the program text, the first statement

executes before the second. In most imperative languages, lists of statements can

be enclosed with begin. . . end or {. . . } delimiters and then used in any context

in which a single statement is expected.

What does idempotent mean?

**Idempotence** ([/](http://en.wikipedia.org/wiki/Help:IPA_for_English)[ˌaɪdɨmˈpoʊtəns](http://en.wikipedia.org/wiki/Help:IPA_for_English#Key)[/](http://en.wikipedia.org/wiki/Help:IPA_for_English) [***eye****-dəm-****poh****-təns*](http://en.wikipedia.org/wiki/Wikipedia:Pronunciation_respelling_key)) is the property of certain [operations](http://en.wikipedia.org/wiki/Operation_(mathematics)) in [mathematics](http://en.wikipedia.org/wiki/Mathematics) and [computer science](http://en.wikipedia.org/wiki/Computer_science), that can be applied multiple times without changing the result beyond the initial application.

Sequencing is important because of side effects.  If a statement or expression does not have side effects, its order of execution does not matter.

**Selection**

if .. endif

if ... elif

C and Java style if statements

The C switch statement is simply a structured form of branching. If you omit the break statements, you can use it to jump into a loop at various points from outside the loop.  Duff's device is a well known example.  Here are a Wikipedia link, [Duff's Device (Links to an external site.)](http://en.wikipedia.org/wiki/Duff%27s_device), and a Stack Overflow link, [Duff's Device (Links to an external site.)](http://stackoverflow.com/questions/514118/how-does-duffs-device-work#514289), to this algorithm.  As a programmer, it is informative to understand this algorithm.  For this course, it serves to illustrate that  case labels in the C switch are just structured branches.