Enumerated Types

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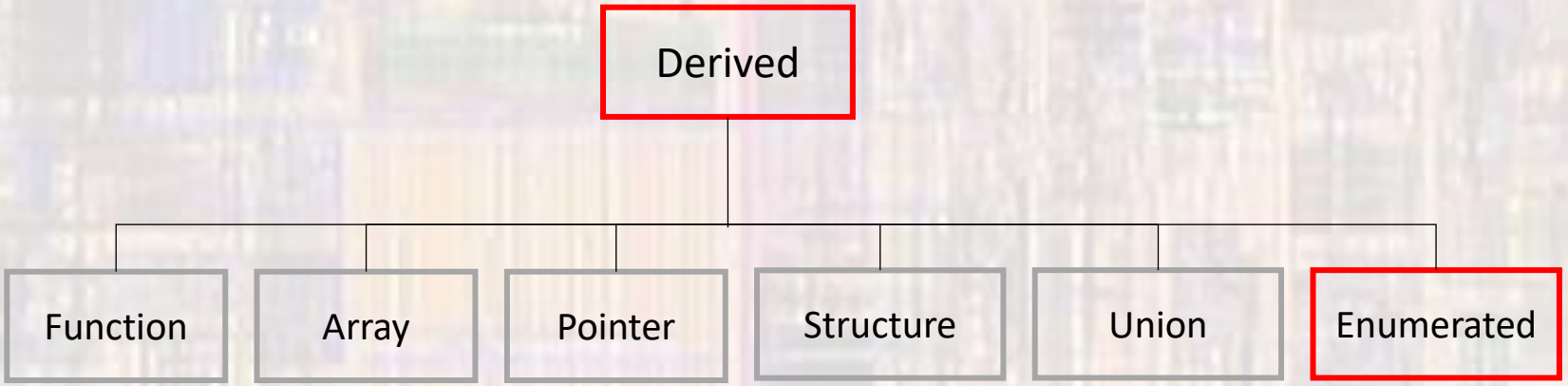
Enumerated Types

- These slides introduce enumerated types
- Upon completion: You should be able interpret and code using enumerated types

Type Definition

- C Types



Type Definition

- Typedef
  - Define a new Type
  - Inherits members and operations from a standard or previously defined derived type
  - Typically done in global area so all parts of the program will recognize it

```
typedef type IDENTIFIER;

typedef int AGE;    // define a new type called AGE
                    // that acts like an int
```

Enumerated Types

- Enum
  - Assign a limited number of values(words) to a variable
  - Define its name and its members (enumerate them)
  - Members are mapped to integer values
    - Normally 0 - n

enum typeName {idenitifier list};

enum wireColor {RED, BLUE, BLACK, WHITE};

wireColor recognizes the words RED, … WHITE as values

RED is mapped to 0, WHITE is mapped to 3

Enumerated Types

- 2 ways to create enumerated variables
  - Identify each variable as an enum variable

```
enum wireColor {RED, BLUE, BLACK, WHITE}; // definition
enum wireColor power;                     // declaration
enum wireColor gnd;
enum wireColor signal;
```

  - Create a new type that is an enum type

```
typedef enum {RED, BLUE, BLACK, WHITE} wireColor;
wireColor power;                          // declaration
wireColor gnd;
wireColor signal;
```

Enumerated Types

- Assign/Use Values

```
power = BLACK;
gnd = WHITE;
signal = RED;

if(power == RED){
…
}
```

Enumerated Types

- Operations
  - Enumerated types are stored as integers
  - All integer operations can be applied to an enumerated type
  - No checking is done to ensure the result is valid

```
                          0    1    2          10   11
typedef enum {JAN, FEB, MAR, …   NOV, DEC} month;
month birthMonth;                          // create a variable of
                                           // type month

if ((birthMonth – 2) >= MAY){
  …
```

Enumerated Types

- Operations

```
                        0    1    2          10   11
enum month {JAN, FEB, MAR,       NOV, DEC};
enum month birthMonth;
enum month currentMonth;

if (birthMonth > currentMonth){
  …

switch(currentMonth){
  case JAN:                          // case 0
    …
  case FEB:                          // case 1
    …
```

Enumerated Types

- Change of Reference

```
                    0    1    2              10    11
enum month {JAN, FEB, MAR,        NOV, DEC};
```

  - suppose we'd like the member numbers to match some other pattern

```
                      1    2    3                    21    22
enum month {JAN=1, FEB, MAR,  ...    OCT=20,NOV, DEC};
```

Enumerated Types

- Anonymous Enumeration
  - Same effect as a #define

  but
  - Subject to scope rules

```
enum {OFF, ON};                 // assign OFF the value 0, ON:  1

enum {SPACE = ' ', COMMA = ',' , COLON = ':'};
```

Enumerated Types

- Scope Considerations
  - Generally, we would like our enum or enum type to be visible anywhere in our file (main and all functions)
  - Place enum or typedef in the global regions
  - Subsequent variable declarations are subject to normal scope rules

```
#include <stdio.h>
enum wireColor {RED, BLUE, BLACK, WHITE};
typedef enum {Jan=1, Feb, …} month;

int main(void){
   enum wireColor power;
   month bday;
   …
}
```

Enumerated Types

```c
/*
 * enum.c
 *
 *  Created on: Feb 8, 2018
 *      Author: johnsontimoj
 */
// examples of enumerated types
//
#include <stdio.h>


// define type in global area so all parts
// of the program can see them
enum wire_color {RED, WHITE, BLUE, BLACK};
typedef enum {JAN = 1, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC} month;

// has to be after the typedef - otherwise not recognized
void print_month(month the_month);

int main(void){
    setbuf(stdout, NULL);

    // declare variables
    enum wire_color gnd;    // enum declaration
    enum wire_color vcc;
    enum wire_color sig;
    month birth_month;      // typedef declaration

    // initialize variables
    gnd = WHITE;
    vcc = BLACK;
    sig = RED;
    birth_month = JUL;

    // enums
    ///////////////
    printf("gnd value is %i\n", gnd);
    printf("vcc value is %i\n", vcc);
    printf("sig value is %i\n", sig);

    if(vcc == BLACK)
        printf("vcc is black\n");
    else
        printf("vcc is not black\n");

    // type def
    ///////////////
    printf("birth month is %i\n", birth_month);

    birth_month++;
    printf("birth month is %i\n", birth_month);

    if(birth_month > APR)
        printf("birth month is after april\n");
    else
        printf("birth month is before or equal to april\n");

    birth_month -= 3;
    printf("birth month is %i\n", birth_month);

    print_month(birth_month);

    birth_month = birth_month << 3;
    printf("birth month is %i\n", birth_month);

    print_month(birth_month);

    return 0;
} // end main

void print_month(month the_month){
    // create an array to allow names to be printed
    const char* month_name[] = {"err", "jan", "feb", "mar", "apr", "may", "jun", "jul", "aug", "sep", "oct", "nov", "dec"};

    printf("birth month is %s\n", month_name[the_month]);

    return;
}// end print_month
```

```
<terminated> (exit value: 0) Cla
gnd value is 1
vcc value is 3
sig value is 0
vcc is black
birth month is 7
birth month is 8
birth month is after april
birth month is 5
birth month is may
birth month is 40
birth month is (null)
```

random luck that this is null, outside the string array bounds