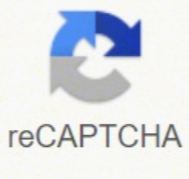




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```
#include "derivative.h"
#include <stdint.h>

void swap(int *num1, int *num2) {

    int temp;
    temp = *num1;
    *num1 = *num2;
    *num2 = temp;
}

int main(void)
{
    int a, b;
    a = 100;
    b = 200;

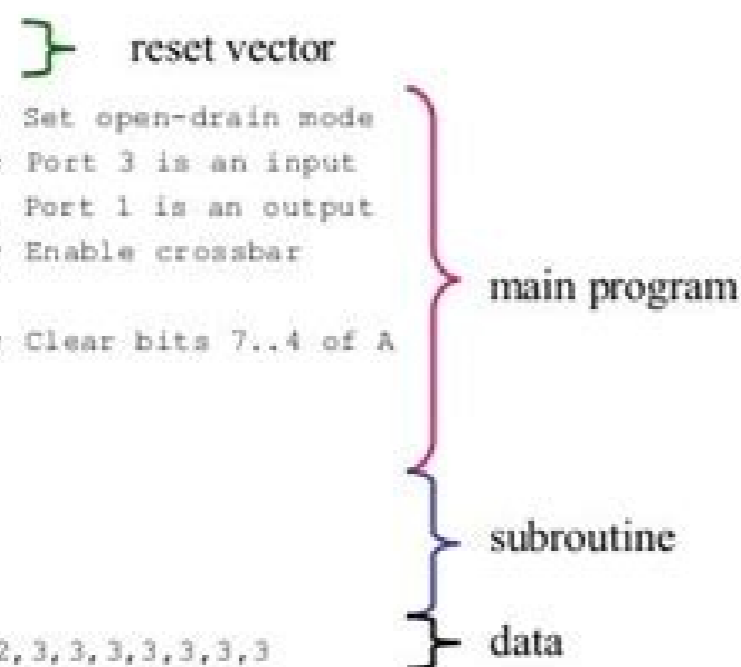
    swap(&a, &b);
    return 0;
}
```

C code to be disassembled to machine code

```
00000000    push    ebp
00000001    mov     ebp, esp
00000003    movzx  ecx, [ebp+arg_0]
00000007    pop     ebp
00000008    movzx  dx, cl
0000000c    lea    eax, [edx+edx]
00000011    add    eax, edx
00000014    shl   eax, 2
00000016    add    eax, edx
00000019    shr   eax, 8
0000001b    sub   cl, 1
0000001d    shr   cl, 1
0000001f    shr   al, 5
00000022    movzx  eax, al
00000025    ret
```

Subroutine – another example

```
; Program to compute square root of value on Port 3 (bits 3-0) and
; output on Port 1.
$INCLUDE (C8051F020.inc)
cseg at 0
ljmp Main
Main:  mov P3MDOUT, #0      ; Set open-drain mode
      mov P3, #0xFF     ; Port 3 is an input
      mov P1MDOUT, #0xFF ; Port 1 is an output
      mov XBR2, #40h    ; Enable crossbar
loop:  mov a, P3
      anl a, #0x0F      ; Clear bits 7..4 of A
      lcall sqrt
      mov P1, a
      sjmp loop
sqrt:  inc a
      movc a, #a + PC
      ret
squares: db 0,1,1,1,2,2,2,2,2,3,3,3,3,3,3,3,3,3
end
```



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Example

```
;Start main loop
clear CLRF PORTB ;reset output portB
start BTFFS PORTA,inres ;test RA0, reset button
      clear ;reset portB if button is pressed
      BTFFS PORTA,inrun ;test RA1, count button
      GOTO start ;test RA0 if button is not pressed
      INCF PORTB ;increase output by 1 if button is pressed
      CALL delay
      GOTO start ;repeat main loop

;delay subroutine
delay MOVWLW OFFH ;delay count value
      MOVWF timer ;copy W to timer register
down DECFSZ timer ;decrement timer register
      GOTO down
      RETRNI

END ;terminate program
```

```
00000000    mov     portb, 0
00000001    btffs  porta, inres
00000002    mov     portb, 0
00000003    btffs  porta, inrun
00000004    goto   start
00000005    incf   portb, 1
00000006    call   delay
00000007    goto   start
00000008    movlw  0ffh
00000009    movwf  timer
0000000a    decfsz timer, 1
0000000b    goto   down
0000000c    retn
0000000d
```

The three identifiers are: A = Candidate for Accredited Persons Program (APP) M = Candidate for Mutual Recognition Agreement (MRA) Program B = Candidate for both APP and MRA Programs Accredited Persons Eligible When the device is a candidate for Third Party Review under the Accredited Persons program, the following codes reflect whether it became eligible under the preexisting program or the expansions program. The interrupt to execute system calls on the x86 processor is hex 2E, with EAX containing the system call number and EDX pointing to the parameter table in memory. Subsequent arguments go in RSI, RDX, RCX, R8, R9, and then subsequent arguments (which no sane programmer would ever use) will go "on the stack" (more about this stack thing later). ; Processor: 386 or later ; Assembler: MASM ; OS: Any Win32-based OS ; Other libraries: Use Microsoft's import library kernel32.lib ; Assemble with "ml hello.asm /c" ; Link with "link hello kernel32.lib /subsystem:console /entry:go" ; -----
386P .model flat extern _ExitProcess@4;near extern _WriteConsoleA@20;near public _go .data msg byte "Hello, World", 10 handle dword ? Still, all we have to do is place calls to C functions in our assembly language program, and link with the static C library and we are set. The general steps for Zip Files are: uncompress the file with WinUnzip, PKUnzip, or other utility; rename file: filename.lis to filename.txt. Real mode addresses are 20-bit values written in the form SEGMENT:OFFSET where the segment and offset are each 16-bits wide and the physical address is SEGMENT * 16 + OFFSET. I've never learned Win64. A DOS program is a collection of segments. SP will be loaded with the size of the stack specified by the programmer, which is perfect because on the x86 a PUSH instruction decrements the stack pointer and then moves the pushed value into the memory addressed by SS:SP. There are many versions of the library, but for single threaded programs, libc.lib is fine. Medical Specialty (Advisory Committee) Regulation No. Medical Specialty Code Anesthesiology Part 868 AN Cardiovascular Part 869 AN Clinical Chemistry Part 872 DE Ear, Nose, & Throat Part 874 EN Gastroenterology & Urology Part 876 GU General Hospital Part 880 HO Hematology Part 864 HE Immunology Part 866 IM Microbiology Part 866 MI Neurology Part 882 NE Obstetrics/Gynecology Part 884 OB Ophthalmic Part 886 OP Orthopedic Part 888 OR Pathology Part 864 PA Physical Medicine Part 890 PM Radiology Part 892 RA General & Plastic Surgery Part 878 SU Clinical Toxicology Part 862 TX Device Name The Device Name uses the format of a noun that is usually followed by one or more adjectives, separated by commas. written dword ? It does some ; initialization, calls a function " main" (which will end up in powers.obj) ; then does more work and finally calls ExitProcess. Writing Optimized Code Assembly language programmers and compiler writers should take great care in producing efficient code. It should be linked * with a C runtime library. CS:0 will point to the code segment and SS:0 to the stack segment. File File name Product Code foiclass.zip Information on How to download The data is available in zipped files for downloading. Programming for Win32 Win32 is the primary operating system API found in most of Microsoft's 32-bit operating systems including Windows 9x, NT, 2000 and XP. The three Class designations are: Class 1 - Devices subject to General Controls, Class 2 - Devices subject to General Controls and Special Controls, and Premarket Clearance Further information on how devices are classified. ; ; Assembler: NASM ; OS: Any Win32-based OS ; Other libraries: Use gcc's import library libkernel32.a ; Assemble with "nasm -fwin32 hello.asm" ; Link with "ld -e go hello.obj -lkernel32" ; ----- global go extern _ExitProcess@4 extern _GetStdHandle@4 extern _WriteConsoleA@20 section .data msg: db "Hello, World", 10 handle: db 0 .asciz "Hello, World" Good to know: NASM and MASM use what is sometimes called the Intel syntax, while GAS uses what is called the AT&T syntax. You can suppress the link step with the -c option to gcc, or do the assembly and linking in one step by telling the linker not to use the C library with -nostdlib. Here is the powers program in NASM: powers.asm: ----- ; Displays powers of 2 from 2^0 to 2^31, one per line, to standard output. If you have floating point arguments, they'll go in XMM0, XMM1, etc. GAS, the GNU assembler. OpenGL Programming in NASM for Win32 For fun, here is a complete assembly language program that implements an OpenGL application running under GLUT on Windows systems: triangle.asm: ----- ; A very simple "Windows" OpenGL application using the GLUT library. The linking step is the same as the NASM example; the only difference is that gcc produces win32 object files with extension .o rather than .obj. We'll assume a 64-bit OS, and we'll also assume you've installed gcc (usually obtained via downloading xcode). We will even include a section on DOS assembly language programs for historical interest. As in the NASM version, we've specified our entry point, and will be passing it to the linker in the -e option. Another minor point is that gas doesn't really care if you define external symbols with some sort of "extern" directive or not. For these files to be useful to you, you'll first have to download them, unzip them, and then import them into a database or word processor for your further processing. To assemble and run: ; nasm -f macho64 hola.asm && gcc hola.o && ./a.out ; ----- global _main extern _puts section .text _main: push rbx ; Call stack must be aligned lea rdi, [rel message] ; First argument is address of message call _puts ; puts(message) pop rbx ; Fix up stack before returning ret section .data message: db "Hola, mundo", 0 ; C strings need a zero byte at the end There are some differences here! C library functions have underscores, and we had to say default rel for some strange reason, which you can read about in the NASM documentation. Anything less than version 6.14 will be extremely painful to use. ; It uses puts from the C library. These files were then compressed ("zipped") in order to save space. * * Assembler: gas * OS: Any Win32-based OS * Other libraries: Use gcc's import library libkernel32.a * Assemble with "gcc -c hello.c" * Link with "ld -e go hello.o -lkernel32" * ----- global go .data msg: asciz "Hello, World" handle: int 0 .text go: ^ handle = GetStdHandle(-11) ^/ push \$-11 call _GetStdHandle@4 mov ^eax, handle ^/ WriteConsole(handle, &msg[0], 13, &written, 0) ^/ push \$0 push \$written push \$13 push \$msg push handle call _WriteConsoleA@20 ^/ ExitProcess(0) ^/ push \$0 call _ExitProcess@4 In fact the differences between the two programs are really only syntactic. Win64: Microsoft's format for Win64. ; Processor: 386 or later ; Assembler: MASM ; OS: DOS 2.0 or later only ; Assemble and link with "ml echo.asm" ; ----- .model small .stack 64 ; 64 byte stack .386 .code start: movzx cx, byte ptr ds:[80h] ; size of parameter string word ah, 40h ; write mov bx, 1 ; ... ; To assemble and run: ; nasm -felf64 hola.asm && ld hello.o && ./a.out ; ----- global _start section .text _start: mov rax, 1 ; system call for write mov rdi, 1 ; file handle 1 is stdout mov rsi, message ; address of string to output mov rdx, 13 ; number of bytes syscall ;

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