

TYPICAL HIERARCHY OF FUNCTIONS FOR ANY DIGITAL DEVICE



APPLICATIONS: GRAPHICAL USER INTERFACES (GUI)

PROGRAMMING: OBJECT ORIENTED LANGUAGE (C++, JAVA)

```
gregcoello ~ -- bash -- 80x24
Last login: Thu Feb 22 09:23:20 on tty000
Gregs-MacBook-Pro: gregcoello$ ls -la
total 128
drwxr-xr-x  41 gregcoello  staff  1312 Feb 12 12:41 .
-rw-r--r--  1 root      admin   224 Nov  9 18:29 ..
-rw-r--r--  1 gregcoello  staff    7 Aug 18 2017 .CUserTextEncoding
-rw-r--r--  1 gregcoello  staff 28676 Feb 23 13:37 .DS_Store
drwxr-xr-x  18 gregcoello  staff   576 Feb 23 13:22 .Trash
-rw-r--r--  1 gregcoello  staff   379 Nov  2 20:47 .Xauthority
-rw-r--r--  1 gregcoello  staff   348 Mar  1 2016 .appleevents
drwxr-xr-x  76 gregcoello  staff 2432 Feb 23 13:45 .bash_sessions
drwxr-xr-x  3 gregcoello  staff   96 Sep 28 2014 .cache
drwxr-xr-x  3 gregcoello  staff   96 Sep 28 2014 .config
drwxr-xr-x  3 gregcoello  staff   96 Aug  2 2014 .cups
drwxr-xr-x  12 gregcoello  staff   384 Dec  8 09:24 .dcopbox
drwxr-xr-x  9 gregcoello  staff  288 Nov 27 28:58 .eclipse
drwxr-xr-x  3 gregcoello  staff   96 Sep 28 2014 .emacs.d
-rw-r--r--  1 gregcoello  staff  329 Sep 28 2014 .gitconfig
drwxr-xr-x 162 gregcoello  staff 5184 Feb 21 17:48 .idm
drwxr-xr-x  3 gregcoello  staff   96 Oct 11 2014 .jmc
drwxr-xr-x  3 gregcoello  staff   96 Dec 18 2014 .netbeans derby
drwxr-xr-x 17 gregcoello  staff  544 Nov 27 19:44 .oracle_jre_usage
drwxr-xr-x  8 gregcoello  staff   256 Nov 27 28:58 .p2
```

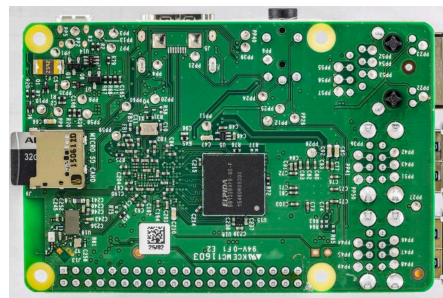
APPLICATIONS: SIMPLE DATA MANIPULATIONS, FILE I/O

PROGRAMMING: HIGH LEVEL LANGUAGE (C, FORTRAN)

```
$ objdump -D a.out | grep -A20 main
00048324
00048324: 84 4c 24 04      lwa    0x4(10esp), %eax
00048328: 83 e4 f0        and   0x0ffffff0(%eax), %eax
0004832c: ff 71 fc        pushl 0xffffffff(%eax)
00048330: 55             push  %ebp
00048332: 89 e5          mov   %ebp, %ebp
00048334: 51             push  %ecx
00048336: 08 00 00 00    mov   0x0, %eax
00048338: 59             pop   %ecx
0004833a: 5d             pop   %ebp
0004833c: 84 61 fc        lwa   0xffffffff(%eax), %eax
0004833e: c3             xcd
00048340: 90             nop
00048342: 90             nop
00048344: 90             nop
00048370: <__libc_csu_fini>
00048370: 55             push  %ebp
00048372: 89 e5          mov   %ebp, %ebp
00048374: 5d             pop   %ebp
00048376: c3             xcd
```

OPERATING SYSTEM (OS) HW/SW CONTROL

PROGRAMMING: ASSEMBLY LANGUAGE (x86, ARM, GNU)



HARDWARE (MOTHERBOARD & PERIPHERALS)