
0X BARE
CMPSC 0XC8 ALLEGHENY COLLEGE 0X7E7
C8 METAL

Spot the difference(s)

Python

```
def main():
    print(“Hello, World!”)

if __name__ == “__main__”:
    main()
```

C

```
int main(void) {
    printf(“Hello, World!”);
    return 0;
}
```

Spot the difference(s)

Python

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def main():
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if __name__ == “__main__”:
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C

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int main(void) {
    printf(“Hello, World!”);
    return 0;
}
```

Spot the difference(s)

Python

```
def divide(a, b):
    return a / b

def main():
    a, b = 5, 2
    q = divide(a, b)
    print(s)

if __name__ == “__main__”:
    main()
```

C

```
float divide (int a, int b) {
    return a / b;
}
int main (void) {
    int a = 5;
    Int b = 2;
    float q = divide(a, b);
    printf(“%f”, q);
    return 0;
}
```

Spot the difference(s)

Python

```
def divide(a, b):
    return a / b

def main():
    a, b = 5, 2
    q = divide(a, b)
    print(s)

if __name__ == “__main__”:
    main()
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C

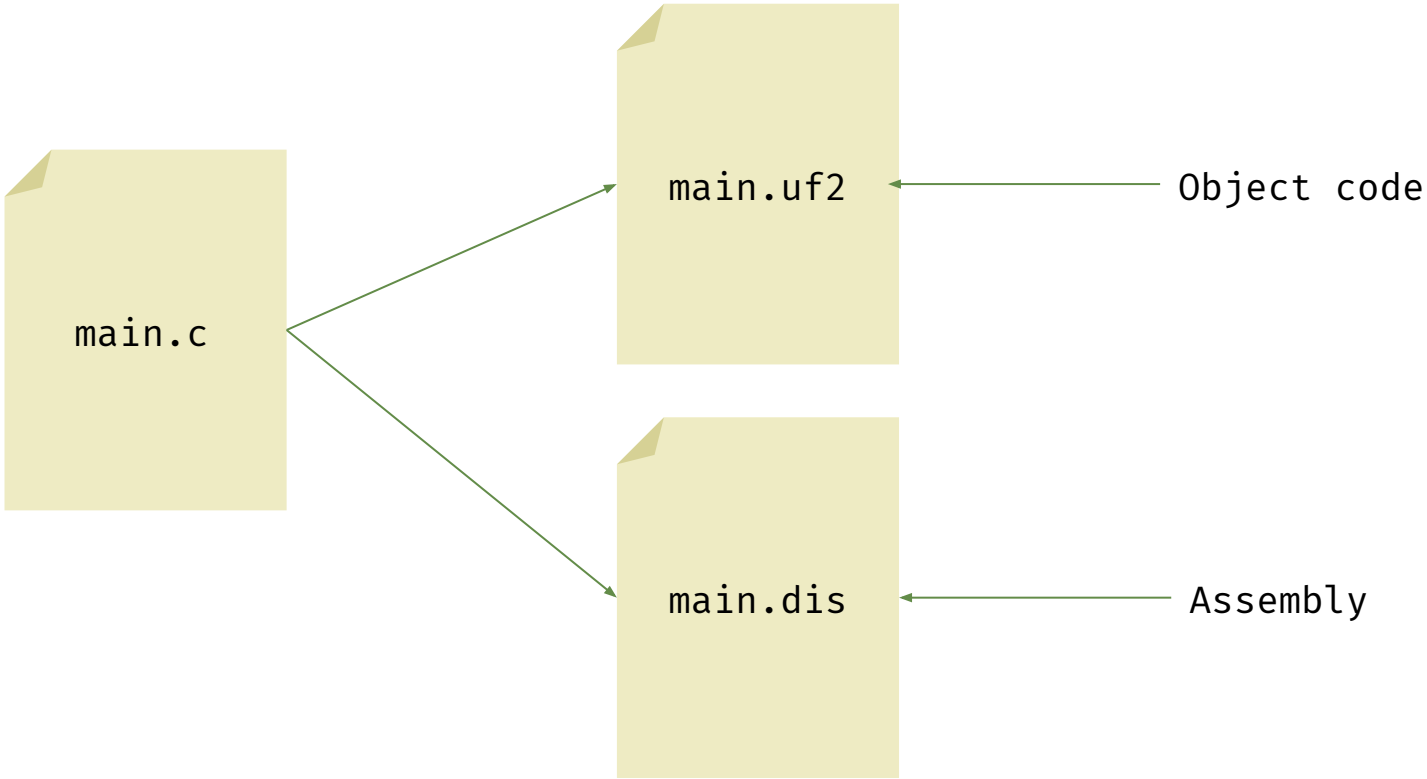
```
float divide (int a, int b) {
    return a / b;
}
int main (void) {
    int a = 5;
    Int b = 2;
    float q = divide(a, b);
    printf(“%f”, q);
    return 0;
}
```

Spot the difference(s)

Assembly	
byte	8 bits
half word	16 bits
word	32 bits
quad	64 bits

C	
char	1 byte
short	2 bytes
int	4 bytes
float	4 bytes
long	4 bytes
long long	8 bytes
double	8 bytes

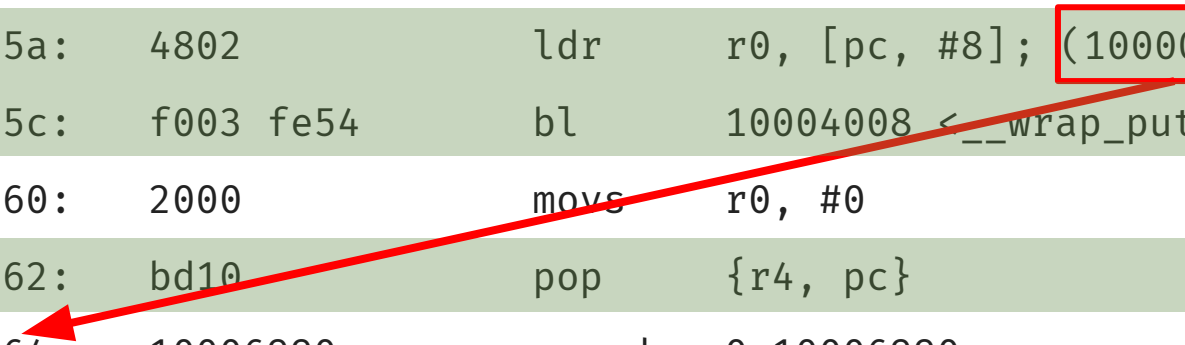
.dis respect



.dis respect

program.dis (hello_world)

```
10000354 <main>:
10000354:    b510            push    {r4, lr}                    STACK FRAME
10000356:    f003 fe93       bl      10004080 <stdio_init_all>
1000035a:    4802            ldr     r0, [pc, #8]; (10000364 <main+0x10>)
1000035c:    f003 fe54       bl      10004008 <__wrap_puts>          PRINTF
10000360:    2000            movs    r0, #0
10000362:    bd10            pop     {r4, pc}                UNROLL STACK FRAME
10000364:    10006990        .word   0x10006990
```



.dis respect

program.dis (adder)

```
10000354 <add>:
10000354: 1840          adds r0, r0, r1                 int sum = a + b;
10000356: 4770          bx   lr                         return sum;

10000358 <main>:
10000358: b510          push {r4, lr}                   STACK FRAME
1000035a: f003 fe99     bl   10004090 <stdio_init_all>
1000035e: 2102          movs r1, #2                     int a = 2;
10000360: 2003          movs r0, #3                     int b = 3;
10000362: f7ff fff7     bl   10000354 <add>             add(a, b);
```

.dis respect

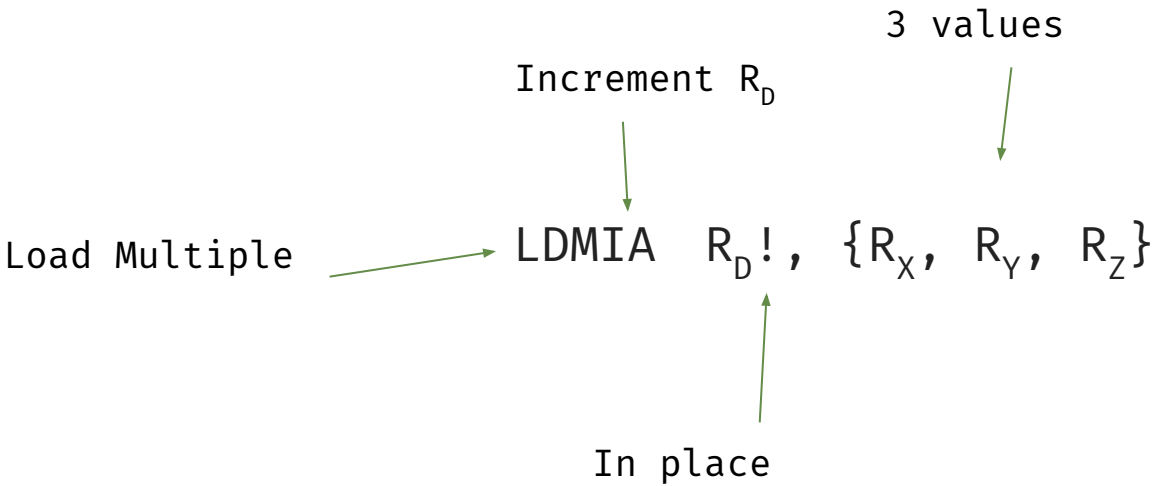
program.dis (adder; with array)

```
10000356: b08b          sub  sp, #44   ; 0x2c   MOVE DOWN IN STACK 44 BYTES OF SPACE
10000358: f003 fea2     bl   100040a0 <stdio_init_all>
1000035c: 4669          mov  r1, sp
1000035e: 4808          ldr  r0, [pc, #32] ; (10000380 <main+0x2c>)      LOAD ARRAY M0
10000360: 000b          movs r3, r1                              HOLD STACK POINTER IN R3
10000362: 0002          movs r2, r0                          HOLD ADDRESS OF ARRAY IN R2
10000364: ca31          ldmia     r2!, {r0, r4, r5}            LOAD MULTIPLE, +4 AFTER
10000366: c331          stmia     r3!, {r0, r4, r5}           STORE MULTIPLE, +4 AFTER
```

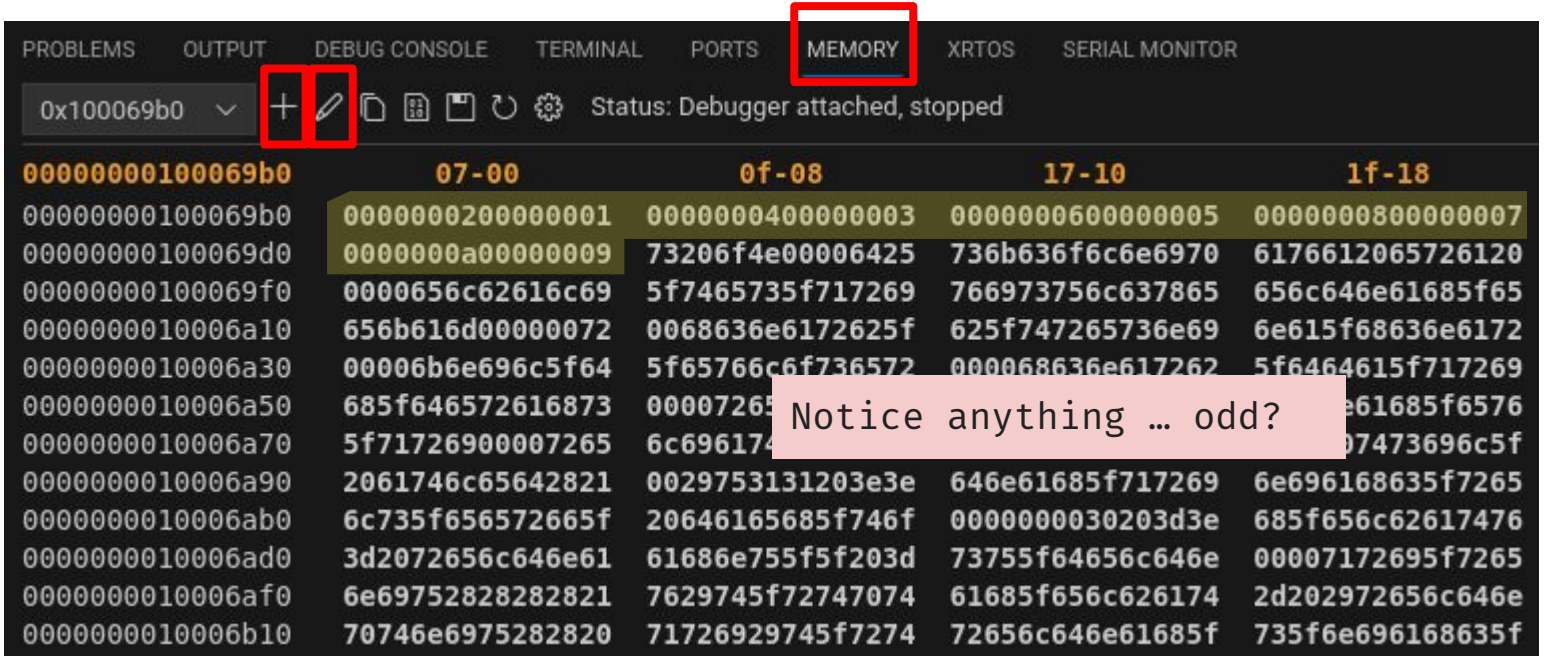
…

PC Program counter (CARDIAC “bug”); current spot in program

LD…M…I…A?


3 values
Increment R_D
Load Multiple
LDMIA R_D!, {R_X, R_Y, R_Z}
In place

But don’t take my word for it…



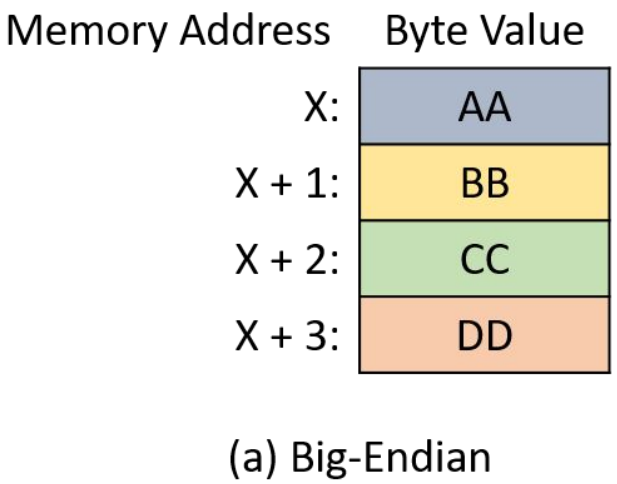
A slide about *Gulliver's Travels*

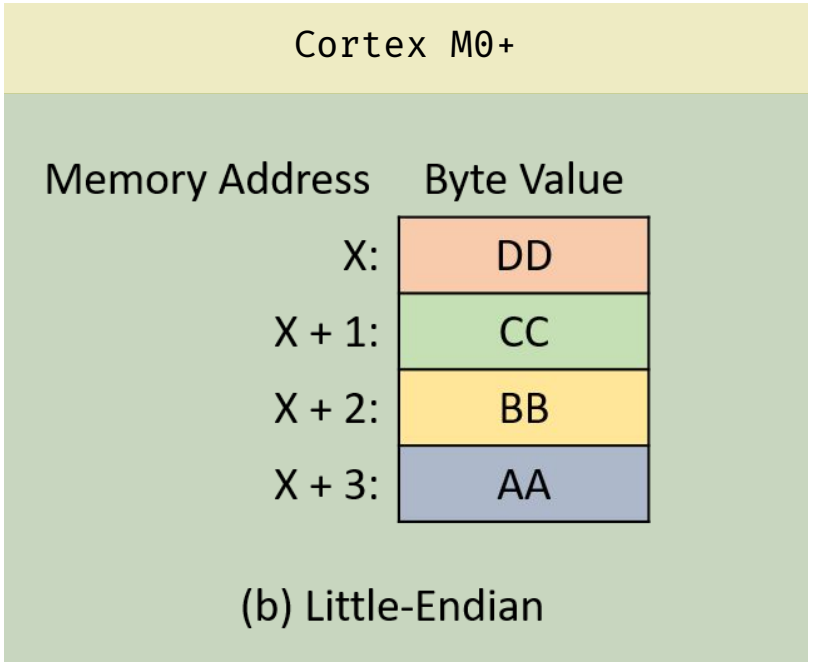
… [a] most obstinate war … began upon the following occasion. It is allowed on all hands, that the primitive way of breaking eggs, before we eat them, was upon the larger end; but his present majesty's grandfather, while he was a boy, going to eat an egg, and breaking it according to the ancient practice, happened to cut one of his fingers. Whereupon the emperor his father published an edict, commanding all his subjects, upon great penalties, to break the smaller end of their eggs.

Jonathan Swift, *Gulliver's Travels*

Yet another *Gulliver's Travels* slide

There are 10_2 types of people who crack their eggs: one at the big end, and one at the little end.





.dis respect

program.dis (adder; with array)

```
10000356: b08b          sub  sp, #44   ; 0x2c   MOVE DOWN IN STACK 44 BYTES OF SPACE
10000358: f003 fea2     bl   100040a0 <stdio_init_all>
1000035c: 4669          mov  r1, sp
1000035e: 4808          ldr  r0, [pc, #32] ; (10000380 <main+0x2c>)      LOAD ARRAY M0
10000360: 000b                                                          STACK POINTER IN R3
10000362: 0002                                                          RESS OF ARRAY IN R2
10000364: ca31                                                           MULTIPLE, +4 AFTER
10000366: c331          stmia    r3!, {r0, r4, r5}          STORE MULTIPLE, +4 AFTER
```

```
int numbers[10] = {1, 2, 3, 4,
                   5, 6, 7, 8,
                   9, 10}
```

…

.dis respect

program.dis (adder; for loop)

```
1000035a: 2400          movs r4, #0                                  int i = 0;
1000035c: 2c09          cmp  r4, #9
1000035e: dc05          bgt.n    1000036c <main+0x18>                i < 10;
10000360: 0021          movs r1, r4        SET CURRENT VALUE OF i IN PRINT REGISTER
10000362: 4803          ldr  r0, [pc, #12] ; (10000370 <main+0x1c>)  LOAD %d
10000364: f003 fe86     bl   10004074 <__wrap_printf>
10000368: 3401          adds r4, #1                                  i++;
1000036a: e7f7          b.n  1000035c <main+0x8>                     }
1000036c: 2000          movs r0, #0
1000036e: bd10          pop  {r4, pc}
10000370: 100069a0  .word    0x100069a0
```

```
for (int i = 0; i < 10; i++) {
    printf("%d", i);
}
```

Sizing it up

```c
int main(void) {
    stdio_init_all();
    int sum = 0;
    int numbers[10] = {1, 2, 3,
                       4, 5, 6, 7,
                       8, 9, 10};
    int array_len = sizeof(numbers) / sizeof(int);
    for(int i = 0; i < array_len; i++){
        printf("%d (%d of %d)\n", numbers[i], i + 1, array_len);
        sum = add(sum, numbers[i]);
        printf("RUNNING SUM: %d\n", sum);
    }
    return 0;
}
```

Python

```
numbers = [1, 2, 3
           4, 5, 6, 7
           8, 9, 10]
```