

```
1.  /*****
2.   * binary.c
3.   *
4.   * David J. Malan
5.   * malan@harvard.edu
6.   *
7.   * Displays a number in binary.
8.   *
9.   * Demonstrates bitwise operators.
10.  *****/
11.
12. #include <cs50.h>
13. #include <stdio.h>
14.
15. int main(void)
16. {
17.     // prompt user for number
18.     int n;
19.     do
20.     {
21.         printf("Non-negative integer please: ");
22.         n = GetInt();
23.     }
24.     while (n < 0);
25.
26.     // print number in binary
27.     for (int i = sizeof(int) * 8 - 1; i >= 0; i--)
28.     {
29.         int mask = 1 << i;
30.         if (n & mask)
31.             printf("1");
32.         else
33.             printf("0");
34.     }
35.     printf("\n");
36.
37.     // that's all folks
38.     return 0;
39. }
```

```
1.  /*****
2.   * hello1.c
3.   *
4.   * David J. Malan
5.   * malan@harvard.edu
6.   *
7.   * Says hello to the world.
8.   *
9.   * Demonstrates use of printf.
10.  *****/
11.
12.  #include <stdio.h>
13.
14.  int main(void)
15.  {
16.      printf("hello, world!\n");
17.      return 0;
18.  }
```

```
1.  .file    "hello1.c"
2.  .text
3.  .globl   main
4.  .align   16, 0x90
5.  .type    main,@function
6.  main:                                # @main
7.  # BB#0:
8.      pushl   %ebp
9.      movl    %esp, %ebp
10.     subl    $24, %esp
11.     leal    .L.str, %eax
12.     movl    $0, -4(%ebp)
13.     movl    %eax, (%esp)
14.     calll   printf
15.     movl    $0, %ecx
16.     movl    %eax, -8(%ebp)           # 4-byte Spill
17.     movl    %ecx, %eax
18.     addl    $24, %esp
19.     popl    %ebp
20.     ret
21. .Ltmp0:
22.     .size    main, .Ltmp0-main
23.
24.     .type    .L.str,@object          # @.str
25.     .section   .rodata.str1.1,"aMS",@progbits,1
26. .L.str:
27.     .asciz    "hello, world!\n"
28.     .size     .L.str, 15
29.
30.
31.     .section   ".note.GNU-stack","",@progbits
```

```
1.  /*****
2.   * tolower.c
3.   *
4.   * David J. Malan
5.   * malan@harvard.edu
6.   *
7.   * Converts an uppercase character to lowercase.
8.   *
9.   * Demonstrates bitwise operators.
10.  *****/
11.
12. #include <cs50.h>
13. #include <ctype.h>
14. #include <stdio.h>
15.
16. int main(void)
17. {
18.     // prompt user for an uppercase character
19.     char c;
20.     do
21.     {
22.         printf("Uppercase character please: ");
23.         c = GetChar();
24.     }
25.     while (c < 'A' || c > 'Z');
26.
27.     // print number in lowercase
28.     printf("%c\n", c | 0x20);
29.
30.     // that's all folks
31.     return 0;
32. }
```

```
1.  /*****
2.   * toupper.c
3.   *
4.   * David J. Malan
5.   * malan@harvard.edu
6.   *
7.   * Converts a lowercase character to uppercase.
8.   *
9.   * Demonstrates bitwise operators.
10.  *****/
11.
12. #include <cs50.h>
13. #include <ctype.h>
14. #include <stdio.h>
15.
16. int main(void)
17. {
18.     // prompt user for a lowercase character
19.     char c;
20.     do
21.     {
22.         printf("Lowercase character please: ");
23.         c = GetChar();
24.     }
25.     while (c < 'a' || c > 'z');
26.
27.     // print number in lowercase
28.     printf("%c\n", c & 0xdf);
29.
30.     // that's all folks
31.     return 0;
32. }
```