Tutorial 6

Hint for the tute:
When you want to read a single character, place a single space before the \%c in the scanf() command, as this will remove any whitespace before the character eg scanf("\%c",&ch);

Question 1.
Write a program that takes a letter given in a define statement and converts it to lowercase by adding 32 to it and prints out the lowercase letter. That is, the ASCII for ‘A’ is 65 and the ASCII for ‘a’ is 97.

Question 2
Change program 1 to read the character from the keyboard rather than from the define statement.

Question 3
Write a program to display the reactance of a capacitor for a frequency entered by the user. The frequency and the capacitance should be entered by the user.
\[ X_c = \frac{1}{2\pi fC} \]

Question 4
Write a program to calculate the total series and parallel resistances for two resistances entered by the user. The results should be displayed.

Question 5
Write a program to read in two hex numbers, display the results of ANDing and ORing the two numbers together. The results should be displayed in hex.

Question 6
An XOR can be used to toggle (change) the state of bit 5 (0x20) which determines upper and lower case. To go from uppercase to lowercase, XOR bit 5 to change its state from 0 to 1. To go from lowercase to uppercase, XOR bit 6 to change its state from 1 to 0. This is called toggling. Write a program to toggle bit 6 of a letter entered by the user and display the new letter.

Question 7
Write a program that starts with the number 0x1 and shifts the bits to the left by 1 bit position. The result should be displayed in hex.
Change the program to shift this new number by 1 bit and display it in hex.

\[ \text{Q what effect does shifting the number 1 bit to the left have?} \]

Question 8
Write a program that starts with the number 0x80 and shifts the bits to the right by 1 bit position. The result should be displayed in hex.
Change the program to shift this new number by 1 bit and display it in hex.

\[ \text{Q what effect does shifting the number 1 bit to the right have?} \]
Solutions

Question 1

#include <stdio.h>
#include <stdlib.h>

#define UC_LETTER 'A'

int main(void)
{
    char letter ;  /* must be a character to represent a letter */

    /* change to lowercase */
    letter = UC_LETTER + 32 ;

    /* display the character (%c) since char */
    printf("%c\n",letter) ;
}

• Output:
    'a'

Question 2

#include <stdio.h>
#include <stdlib.h>

int main(void)
{
    char letter ;  /* must be a character */
    char uc_letter ;  /* uppercase letter entered */

    /* enter the uppercase letter */
    scanf(" %c",&uc_letter) ;

    /* change to lowercase */
    letter = uc_letter + 32 ;

    /* display the character (%c) since char */
    printf("%c\n",letter) ;
}

• Output:
    for 'A' is 'a'
### Question 3

```c
#include <stdio.h>
#include <stdlib.h>

#define PI 3.1415

/* you can use M_PI rather than PI. However you must include math.h */

int main(void)
{
    double freq; /* frequency */
    double cap; /* capacitance */
    double xc; /* reactance */

    /* enter the frequency and capacitance */
    printf("Enter the frequency ");
    scanf("%lg", &freq);
    printf("Enter the capacitance");
    scanf("%lg", &cap);

    /* calculate reactance of capacitor */
    xc = 1.0 / (2.0 * PI * freq * cap);

    /* display the reactance(%lg) since double */
    printf("Reactance = %lg\n", xc);
}
```

- **Output:**
  
  Given $f = 1000$, $C = 1e-6$
  
  "Reactance = 159.16"
Question 4

#include <stdio.h>
#include <stdlib.h>

int main(void)
{
    double r1 ; /* resistor 1 */
    double r2 ; /* resistor 2 */
    double series ; /* result of the series calc */
    double para ; /* result of the parallel calc */

    /* enter the resistances */
    printf("Enter the first resistance ") ;
    scanf("%lg",&r1) ;
    printf("Enter the second resistance ") ;
    scanf("%lg",&r2) ;

    /* calculate the series resistance */
    series = r1 + r2 ;

    /* calculate the parallel resistance */
    para = (r1 * r2) / (r1 + r2) ;

    /* display the resistances since double */
    printf("Series : %lg\n",series) ;
    printf("Parallel : %lg\n",para) ;
}

• Output:
  Given R1 = 2, R2 = 3
  "Series : 5"
  "Parallel : 1.2"
# Question 5

```c
#include <stdio.h>
#include <stdlib.h>

int main(void)
{
    int num1;  /* first number */
    int num2;  /* second number */
    int result_and;  /* result of the AND */
    int result_or;  /* result of the OR */

    /* enter the numbers in hex */
    printf("Enter the first number ");
    scanf("%x",&num1);
    printf("Enter the second number ");
    scanf("%x",&num2);

    /* calculate the AND */
    result_and = num1 & num2;

    /* calculate the OR */
    result_or = num1 | num2;

    /* display the results (\%x) since in hex */
    printf("\nAND: \%x\n",result_and);
    printf("\nOR: \%x\n",result_or);
}
```

- **Output:**
  
  Given num1 = F3, num2 = F5
  
  "AND: F1"
  
  "OR: F7"
Question 6

```c
#include <stdio.h>
#include <stdlib.h>

int main(void)
{
    char new_letter; /* letter with changed case */
    char letter;   /* letter entered */

    /* enter the letter */
    scanf(" %c",&letter);

    /* change to lowercase */
    new_letter = letter ^ 0x20; /* xor bit 5 */

    /* display the character (%c) since char */
    printf("%c\n",new_letter);
}
```

- Output:
  - for 'A', output is 'A'
  - for 'z', output is 'Z'

Question 7

```c
#include <stdio.h>
#include <stdlib.h>

#define NUM 0x1

int main(void)
{
    int result; /* result of shifting 1 position to the left */

    /* shift the number 1 bit position to the left */
    result = NUM << 1;

    /* display the result (%x) since hex */
    printf("%x\n",result);
}
```

- Output: 
  - "2"

- Answer: The left shift multiplies the number by 2.
#include <stdio.h>
#include <stdlib.h>

#define NUM 0x80

int main(void)
{
    int result; /* result of shifting 1 position to the right */

    /* shift the number 1 bit position to the right */
    result = NUM >> 1;

    /* display the result (%x) since hex */
    printf("%x\n",result);
}

• Output: "40"

• Answer: The right shift divides the number by 2.