1806ICT Programming Fundamentals

Bitwise Operators, Enumerations, Macros, Recursion

1. Write a function that counts the number of bits that are set to "1" in a given integer number. Use your function to determine if a given integer number is a power of two.

   Sample run:

Input	Output
16	1 16 is a power of two
14	3 14 is not a power of two

2. Write a function called `prevMonth()` that returns the previous month. Start with the code

```
enum month {jan = 1, feb, mac, apr, may, jun, jul, aug, sep, oct,
nov, dec};
typedef enum month Month;
```

   If `jan` is passed as an argument to the function, then `dec` should be returned.

   Write another function that prints the name of a month, i.e. if the enumerator `jan` is passed as an argument, then `January` should be printed.

   Write a program that takes in an integer between 1 and 12, and prints out the corresponding month, with its preceding month.

   Sample run:

Input	Output
1	January December
5	May April

3. Define a macro `swap(t, x, y)` that will swap two arguments `x` and `y` of a given data type `t`. Test your macro in a program.

   Sample run:

Input	Output
2 4	Before: 2 4 After: 4 2
2.3 4.6	Before: 2.3 4.6 After: 4.6 2.3

4. Write a recursive function `power(base, exponent)` that when invoked returns

$$\texttt{base}^{\texttt{exponent}}$$

   For example, `power(3, 4) = 3*3*3*3`. Assume that `exponent` is an integer greater than or equal to 1.

   Hint: The recursion step would use the relationship

$$base^{exponent} = base * base^{exponent - 1}$$

and the base case is when `exponent` is equal to 1 because $base^1 = base$.

5. The process to convert a decimal number to a binary number is as follows:
   - Recursively divide the decimal number by 2, noting the remainder each time (which will be either 0 or 1).
   - When you hit 0, write the remainders in reverse for the answer

   For example, to convert 710_{10} to its binary equivalent:

   710 / 2 = 355, remainder 0
   355 / 2 = 177, remainder 1
   177 / 2 = 88, remainder 1
   88 / 2 = 44, remainder 0
   44 / 2 = 22, remainder 0
   22 / 2 = 11, remainder 0
   11 / 2 = 5, remainder 1
   5 / 2 = 2, remainder 1
   2 / 2 = 1, remainder 0
   1 / 2 = 0, remainder 1

   Putting the remainders together (in reverse order) gives $710_{10} = 1011000110_2$

   Write a recursive program to convert a decimal number to its binary equivalent.

6. Given a string, compute recursively a new string where all the lowercase 'x' characters have been changed to 'y' characters.

   Sample run:

Input	Output
codex	codey
xxhixx	yyhiyy

7. A palindrome is a string that is spelled the same way forward and backward. Some examples of palindromes are: “radar”, “able was i ere i saw elba” and, if you ignore blanks, “a man a plan a canal panama”. Write a recursive function `testPalindrome` that returns 1 if the string stored in the array is a palindrome and 0 otherwise. The function should ignore spaces and punctuation in the string.