United International University
Department of CSE
CSE 1112: Structured Programming Language Lab
Final Examination | Spring 2023 | Set B
Duration: 11:30 - 1:30
Time: 1 Hour 20 Minutes | Full Marks: 25

Name:

Class ID:

Note: Figures on the right-hand side indicate full marks.

1. Write a program that checks whether a number is a "Mersenne prime" or not. A Mersenne prime is a number that has the following properties: **13 Marks**
   a. The number is prime
   b. The number is one less than a power of two

   For example, the number 31 is a Mersenne prime, because it is a prime number, and it is one less than 32, which is a power of two. However, the number 15 is not a Mersenne prime, because even though it is one less than 16 (which is a power of two), it is not a prime number.
   Your job is to write a program that takes an integer as input and then prints 'Yes' if it is a Mersenne prime and 'No' if it is not.
   For that purpose, you have to write the following functions
   a. `int is_prime(int x)`: This function returns 1 (or nonzero/true value) if the integer x is prime and 0 otherwise
   b. `int power_of_2(int x)`: This function takes an integer as input and checks if it is a power of two or not. If x is a power of two, this function returns 1 (or nonzero/true value) and 0 otherwise. **You must write this function using recursion.**
   c. `int is_mersenne(int x)`: This function takes an integer as input and returns 1 (or nonzero/true value) if it is a Mersenne prime and 0 otherwise. **You should make function calls to functions (a) and (b) in this function.**

   See the following sample input and output for clarification:

Sample Input	Sample Output
100	No
31	Yes
15	No
71	No
131071	Yes

2. Ash Ketchum from Pallet Town is an avid collector of Pokemon Cards. But now he is becoming old and has got a job, so he wants to sell all of his Pokemon cards to others so that they can have the joy of Pokemon. But first, Ash wants to find out how much money he will make by selling the cards in his collection.
Your job is to write a program to help Ash calculate the price of all of his cards.
In your program, each Pokemon card should be represented by a structure, containing the following member variables:

```
struct card {
      char name[60];   // name of the Pokemon card
      int stage;       // stage of the Pokemon, can take
                       // values 0, 1 or 2
      int HP;          // HP (hit points) of that Pokemon
};
```

The price of each card is calculated in the following method:

a. The base price of each card is 50 Tk (If the card has no other extra features, the card can be sold for 50 Tk)
b. The price of the card increases by the number of hit points it has. That is, if the HP of a card is 140, the price of that card will increase by 140 Tk. If its HP is 80, the price of that card will increase by 80 Tk instead.
c. If the stage of the card is equal to 1, its price increases by 30 Tk. If its stage is equal to 2, its price increases by 70 Tk instead. (If its stage is equal to 0, no price increase happens due to stage)
d. If the name of the Pokemon card ends with the letter `'X'` (the capital letter only), the price of the card increases by 200 Tk

Your program should take information about all the cards in Ash's collection as input, and then print the total price obtainable by selling all of Ash's cards.
The first line of input contains an integer `N`, indicating the number of cards in Ash's collection. The next lines contain information about the individual Pokemon cards. Each group of three lines contains the name, stage, and HP of that individual Pokemon card respectively. You can be sure that the name of a card is a single word.
Your program should have the following properties:

1. Your program should represent all of the cards in Ash's collection using an array of structures of type `struct card`
2. **You need to make the following function and call it in your program to calculate the result -**
   `int ends_with(char *input, char letter)`: returns 1 (or nonzero/true value) if the string `input` ends with the character `letter`

   You may add additional functions if required for the implementation of the program.

See the following sample input output for clarification. **12 Marks**

Pictures of the Pokemon cards in Ash's Collection are given after that as well for reference.

<table>
<tr><th>Sample Input</th><th>Sample Output</th><th>Explanation</th></tr>
<tr>
<td>4
Charizard
2
120
Pikachu
0
40
ShayminEX
0
110
Lucario
1
90</td>
<td>870</td>
<td>The four Pokemon Cards are

Name: Charizard
Stage: 2
HP: 120

Name: Pikachu
Stage: 0
HP: 40

Name: ShayminEX
Stage: 0
HP: 110

Name: Lucario
Stage: 1
HP: 70

The price of the first card
= 50 (base price) + 120 (HP) + 80 (for stage 2)
= 250

The price of the second card
= 50 (base price) + 40 (HP)
= 90

The price of the third card
= 50 (base price) + 110 (HP) + 200 (for ending in 'X')
= 360

The price of the fourth card
= 50 (base price) + 90 (HP) + 30 (for stage 1)
= 170

∴ Total price of all the cards
= 250 + 90 + 360 + 170
= 870</td>
</tr>
</table>

Pictures of the four Pokemon cards (Note that 'basic' Pokemon are Pokemon with stage 0):