

B.Tech. (I) - ICP-132
Assignment 1

Level 0

1. Read two strings and print the number of characters present in them.

Eg

```
Input:
      Helo
      1233h3

Output:
      4
      6
```

2. Read three strings and print them in dictionary order

Eg

```
Input:
      efd
      x
      eda

Output:
      eda
      efd
      x
```

3. Read three real numbers x, y and z and print the value of $(x^2*y)/z$.

```
Input:
      2.1
      0.7
      0.3

Output:
      10.29
```

Level 1

1. Print the smallest and largest values that your compiler can support for int, short int, float, double and char. Print the precision of float and double. How is precision defined?

(Hint: See https://iws60.iiita.ac.in/wiki/cpp/doku.php?id=dgg:ch_02:ranges)

2. Read two numbers x and y and using only one "cout" print if they are even or odd.

Eg

```
Input:
      2
      3

Output:
      even
      odd
```

3. Read 3 integers and print the smallest of char, short int, int or long int that will be able to hold the values. The type could be unsigned if the number is non-negative. Give preference to signed over unsigned.

Eg

```
Input:
      5
      187
      4294967295

Output:
      char
      short int
      unsigned int
```

Level 2

1. Write a program to show 5 different ways to create a string.
2. Write a program that creates a string that is made of first 3 characters of two input strings.

Eg:

```
Input:      4562332423
           ffdsgf
Output:     456ffd
```

3. Two strings have values "32" and "123.21". Convert them into int and float and print the values when 10 is added to them (ie print numbers 42 and 133.21).

Level 3

1. Write a C++ program that takes 3 integers as input and prints if they are divisible by 2, 3 or 6. If the number is divisible by more than one of the three it should print the greater of all. The number of digits could be 1000.

Eg

```
Input:      2
           1234567890123456789012345678901234567890
           9
Output:     2
           6
           3
```

2. Given three string of 5 letters, print the number of distinct number of letters.

Eg

```
Input:      abccb
           edasf
           aavav
Output:     3
           5
           2
```

3. Print the gap number of letters between the letters X and Y in a given string.

```
Input:      abcXijklmYsada
Output:     5
```

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Assignment 2

Level 0

1. Read two integers and print numbers from the lower integer to the higher

Input:

10

6

Output:

6

7

8

9

10

2. Read 'n' real numbers and print the maximum. First input is 'n'.

Eg

Input:

5

1.0

10.2

2.4

-4.2

2.5

Output:

10.2

3. Find average of 'n' numbers.

Input:

3

0.7

0.3

2.5

Output:

1.1667

Level 1

1. Read integer 'n' and a string 's' print 's' n-times.

Input:

4

sda

Output:

sdasdasdasda

2. Given a string print the number of letters in between 'X' and 'Y'. Print -ve if 'Y' comes earlier to 'X'.

Input:

abXabcdeY

Output:

5

3. Print the first 'n' numbers in Fibonacci series.

Given: $Fib(n) = Fib(n-1) + Fib(n-2)$; $Fib(0) = 0$; $Fib(1) = 1$

Input:

10

Output:

0 1 1 2 3 5 8 13 21 34

Level 2

1. Find standard deviation of 'n' numbers. (Normalise by N-1)

Input:

3
0.7
0.3
2.5

Output:

1.179

2. Given a string, print ASCII values of each letter.

Input:

AbC

Output:

65 98 67

3. Given a string, find the mod 10 of sum of all ASCII values.

Input:

AB

Output:

1

Level 3

Read <http://acm.uva.es/problemset/float-in-competition.pdf>

1. Fix the bug in the following program:

```
#include <iostream>
```

```
using namespace std;
```

```
int main()
```

```
{
```

```
    float D;
```

```
    D=0.1;
```

```
    while ( 1.0-D != 0.0 ) {  
        cout << D << endl;  
        D=D+0.1;  
    }
```

```
    return 0;
```

```
}
```

2. Write a program that correctly prints the shorter of the two paths, AOB and COD, where O is the origin; points A, B, C and D are successively (2, 5, 31), (1,2,9), (0, 7, 27) and (1,8,10).

3. Given 'n' strings, print them in dictionary order.

Input: 3

who knows?
hello world
I am the best! :)

Output:

I am the best! :)
hello world

who knows?

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Assignment 3

Level 0

1. Given natural numbers x and y construct a vector with numbers $1^2, 2^2, \dots, (x-1)^2, (x+1)^2, (x+2)^2, \dots, y^2$. Find the average value.
2. Read 'n' numbers and print the median, mode and range.
3. Find maximum of 'n' strings.

Input:

3
hello
world
yes

Output:

world

Level 1

1. Numbers $1^2, 2^2, \dots, (x-1)^2, (x+1)^2, (x+2)^2, \dots, y^2$ are given. Find x and y using a function.

Input:

1
4
9
25
36

Output:

x=4
y=6

2. Logistic function is given as $X_{n+1} = G \cdot (X_n) \cdot (1 - X_n)$, where X_n is the population in n 'th year and X_{n+1} is the population in $(n+1)$ th and G is the growth constant. It is used in ecology to model population of predator prey systems, where their numbers and growth constant show interesting dynamics. For G in range $(1,3)$ population will reach a stable value while more complicated results appear from higher G . For a given X_0 and G as initial values, find the average population of predator between $(n-50)$ and n years.
3. Given $n \times n$ matrices A and B , find $A \cdot B'$

Level 2

1. Insert x^2 into its correct place as mentioned in Level 1 prob 1.
2. Using Lagrange interpolation formula, find $\sin(49)$ using $\sin(10), \sin(20), \sin(33), \sin(45), \sin(48)$, and $\sin(57)$. Using math library find the difference from the actual value.
3. Given a vector write a function to sort it in descending order.

Level 3

(See "Introduction to Algorithms", by TH Corman, CE Leiserson, RL Rivest)

1. Implement a Queue on a vector v of integers. The functions to be built are:
void enqueue(v , i), where i is the number to be enqueued
int dequeue(v),
int size(v),
int front(v),
2. An $n \times n$ matrix (D) is given that shows the distance between any two cities.
Using Floyd-Warshall algorithm, find the shortest between any two cities.
3. Task scheduling problem: Given n tasks and their completion times the best way to process jobs is using a 'greedy technique' in such a way that the tasks with fastest completion times are taken up earlier.
Given a set of n tasks and their completion times, print the order in which tasks should be taken up.

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Assignment 4

Level 0

1. Given natural numbers x and y construct a list with numbers $1^2, 2^2, \dots, (x-1)^2, (x+1)^2, (x+2)^2, \dots, y^2$. Find the average value from the stored list using a function.
2. Copy list created as in problem 1 into a new list (a) using a function, and (b) without using a function.
3. Make a list of first 10 prime numbers.

Level 1

1. Make a list of vectors that contains two vectors such that:
 - a. first vector has first 10 positive odd numbers, and
 - b. second vector has first 15 positive even numbers.Print all the numbers stored.
2. Make a vector of list such that:
 - a. first list has first 10 positive odd numbers, and
 - b. second list has first 15 positive even numbers.Print all the numbers stored.
3. Let $L1$ and $L2$ be two lists such that:
 $L1 = 1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 5$
 $L2 = 15 \rightarrow 14 \rightarrow 13 \rightarrow 12 \rightarrow 11$. Create a list $L3 = L1 + L2$ such that:
 $L3 = 1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 5 \rightarrow 15 \rightarrow 14 \rightarrow 13 \rightarrow 12 \rightarrow 11$

Level 2

1. Insert x^2 into its correct place as mentioned in Level 0 prob 1 in a given list.
2. Let $L1$ and $L2$ be two lists such that:
 $L1 = 1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 5$
 $L2 = 15 \rightarrow 16 \rightarrow 17 \rightarrow 18 \rightarrow 19$. Create a list $L3 = L1 + L2$ such that:
 $L3 = 16 \rightarrow 18 \rightarrow 20 \rightarrow 22 \rightarrow 24$
3. A stack is a data structure which is opposite to queue. Which ever element comes last will be the first to move out. Using a list L of integers, implement functions given below
 - a. void push(L, i), where i is the number to be enqueued
 - b. int pop(L), returns the last element put in the stack
 - c. int size(L), returns the number of elements in the stack L
 - d. int top(L), returns the element that will be popped next in L

Level 3

1. Use a list L to implement a queue as given in Assignment 3.
2. Given a list with several elements, insert elements 1 to 10 at i 'th element.
3. Given a list of integers, remove all the duplicates using a function `uniq(L)`.

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Assignment 5

Level 0

1. Read 2 mobile numbers and roll numbers and print them using maps.

Eg

Input:
3753215444 God
005345545423 Lord

Output:
3753215444 God
5345545423 Lord

2. A DNS table associates URL with Ip no.s. Given the following DNS table, print the IP for a given URL.

Eg

DNS Table:
yahoo.com 206.190.60.37
google.com 72.14.207.97
google.com 72.14.207.97
mail.google.com 72.14.207.97
rediff.com 204.2.177.16

Input:
google.com

Output:
72.14.207.99

3. Given the SR No. of a student, print the name

Data:
MIR2009120 ABC
MIR2009567 XYZ
MIR2009657 IJK

Input:
MIR2009567

Output:
XYZ

Level 1

1. A sparse matrix is a matrix with very few non-zero elements. Given a sparse matrices A and B of order 100x100, print C=A+B. You shall be given only the non-zero elements and must print only the non-zero elements. All elements which are zero should not be stored or printed!

Data:
A:
A(1,90) = 10
A(2,10) = 70
A(5,20) = 20

B:
B(1,90) = -10
B(2,10) = 10
B(5,20) = 50
B(7,10) = 10

Output:
C(2,10) = 20
C(5,20) = 70
C(7,10) = 10

2. Store the following data in a memory as a map and print it as a table. It consists of SR No., marks and you must find the average.

Eg

```
Data:
      IMB2009123      80.0      93.5      91.5
      IMB2009124      87.5      53.0      71.0
      IMB2009125      81.5      83.0      41.5

Input:
      IMB2009124

Output:
      IMB2009124      87.5      53.0      71.0      70.5
```

3. You are given movie names, name of Director, Producer, Hero(s) and Heroine(s). Given the movie name, print the names of the heros.

Eg

```
Data:
      Movie Name: Fool N Final
      Producer: Firoz A. Nadiadwala
      Director: Ahmed Khan
      Hero: Sunny Deol, Shahid Kapur, Suniel Shetty, Jackie Shroff
      Heroine: Ayesha Takia

      Movie Name: Dharm
      Producer: Sheetal Vinod Talwar
      Director: Bhavna Talwar
      Hero: Pankaj Kapoor
      Heroine: Supriya Pathak

Input:
      Dharm

Output:
      Pankaj Kapoor
```

Level 2

1. Perform sparse matrix multiplication of two sparse matrices of order 100x100.
2. You are given number plates of vehicles in which the leading letters indicate states. Print all the number plates of UP.

Eg:

```
Data:
      AP12 3423
      BH45 431
      KN63 355
      UP70 6533
      UP92 3423

Output:
      UP70 6533
      UP92 3423
```

3. You are given first name and last names of 5 people of which two have same first name and three share the last name. Find if any of them have both first and last names as same using map!

Level 3

1. Huffman decoding is done using a lookup table. Each letter has a binary code associated and the length could be different. The decoding starts from the left side as shown below. Given the table, decode a text message.

Eg

Data:

T	10
S	00
<space>	01
I	110
E	1110
H	11110
A	11111

Input:

101111011100001110000111111011011100010

(Should be split as "10 11110 110 00 01 110 00 01 11111 01 10 1110 00

10")

Output:

THIS IS A TEST

2. Given actor name in 1.3, print the movie name(s).
3. Given the IP no as in 0.2, print all the URLs with the same IP.

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Assignment 6

Level 0

1. Make a class called "point" with two integer data members x and y. Show how to create and use two points p1 and p2.
2. Create a student record class "st_rec" that has the following data members: SR No., Name, marks in ICP, SDC, EDC, PHY, MAT and CSL, and Semester grade. Show how to use it.
3. Create a "human" class with private data members Age and Salary and public data members Father and Mother. Show how to set the values of Age and Salary using a constructor.

Level 1

1. Using the Point class as mentioned above, write a function to compute distance between the points p1 and p2.
2. In the class "st_rec" as above, add a method that computes grade based on the total marks as follows

```
if ( failed in any subject )
    grade = "F"
else if ( total < 40% )
    grade ="F"
else if ( total < 50% )
    grade ="D"
else if ( total < 60% )
    grade ="C"
else if ( total < 70% )
    grade ="B"
else if ( total < 80% )
    grade = "B+"
else if ( total < 90% )
    grade = "A"
else
    grade = "A+"
```
3. Write methods to see and modify Age and Salary in the class "human".

Level 2

1. Create a class p4 with which can store 4 points (x1,y1) through (x4,y4). Write the following methods.

```
dist: prints distance between first 2 points
angle: prints angle between first 3 points
area: finds area of the quadilateral enclosed by the 4 points
closest: finds the point closest to origin
```
2. Write a class "Hello" with a method "helo" that prints "Hello!". It should also have a method "count" that gives the number of times the method "helo" was called. No other public data member or public method is allowed apart from "helo" and "count".

3. Create a class "Poll" that has a question "Q" and methods "yes", "no" and "results". The following rules are to be followed:

1. The programmer should be able to vote using "yes" or "no"
2. Once "results" method is called, results are shown.
3. After results are shown, "yes" and "no" methods will not change results and an error message is printed that the poll is over!

Level 3

Read operator overloading on classes, at least for '<'. See "Sample Code" in the Wiki.

1. Create a vector of objects of class "points" and put 5 objects. Sort the objects (points) as per the following rule:

```
if ( x1 < x2 )
    p1 < p2
else if ( y1 < y2 )
    p1 < p2
else
    p1 > p2
```

2. Create an class with a list<int> as a data member. Add two objects where addition is defined as sum of corresponding list elements. Hence if ob1 has a list <1, 2> and ob2 <7, 5, 4> then the result is ob3=ob1+ob2 where ob3 has a list <8, 7, 4>. Missing elements are treated as zero as in the case of the third element.

3. Create a class "Matrix" that can store a nxm matrix where n and m are user specified. Define an operator '*' so that the result is matrix multiplication.

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Assignment 7

Level 0

1. Given a number n by the user, create a file `data_n.txt` with each line having i , i^2 and i^3 . If the file `data_n.txt` already exists, the program should print error message and quit.

Eg

Input:

5

Output: (file `data_n.txt`)

1, 1, 1

2, 4, 8

3, 9, 27

4, 16, 64

5, 25, 125

2. Remove the commas from the `data_n.txt`. If the file `data_n.txt` does not exist, then the program should print the error message and quit.

3. Write a program that reads `data_n.txt` and appends it to a file `data_an.txt`. The program should create `data_an.txt` if it is not found and should print a message that the file has been created.

Level 1

1. Manually remove the second line from `data_n.txt`. Write a program to print the missing lines in `data_n.txt`.

2. A user enters multiple integers in three lines. Print the number of integers in each line and print their value doubled. The numbers are white space separated.

Eg

Input:

5 3 2 2

1

23 2 1

Output:

4: 10 6 4 4

1: 2

3: 46 4 2

3. A user enters multiple reals in three lines. Print the number of reals in each line and print their value doubled to single decimal accuracy. The numbers are comma separated.

Eg

Input:

5.1,3.2,2.1,2.1

1.0

22.5,3.4,1.0

Output:

4: 10.2 6.4 4.2 4.2

1: 2.0

3: 45.0 6.8 2.0

A data base is a collection of records. A record is a collection of fields. The following questions are based on two data bases, SwissProt and Nasdaq. The files are available at:

<http://profile.iiita.ac.in/sanjeev/courses/icp/icp2009/assg/sprot.txt.gz>
<http://profile.iiita.ac.in/sanjeev/courses/icp/icp2009/assg/nasdaq.txt.gz>

SwissProt: The file is a data base of proteins. Records are stored sequentially. Some fields might be missing in individuals records. Content of the field is preceeded by a two letter code that identifies the name of the field. A record begins with the field 'ID' and ends with '//'.
 >>>

Eg.

```

ID      104K_SHEAN                      Reviewed;                      893 AA.
AC      Q4U9M9;
DT      01-APR-1990, integrated into UniProtKB/Swiss-Prot.
DT      01-APR-1990, sequence version 1.
DT      24-JUL-2007, entry version 37.
DE      104 kDa microneme/rhoptry antigen precursor (p104).
GN      OrderedLocusNames=TP04_0437;
OS      Theileria parva.
SQ      SEQUENCE      893 AA;  101921 MW;  2F67CEB3B02E7AC1 CRC64;
        MKFLVLLFNI LCLFAPILGAD ELVMSPIPTT DVQPKVTFDI NSEVSSGPLY LNPVEMAGVK
        YLQLQRQPGV QVHKVVEGDI WIWNEEMPL YTCAIVTQNE VPYMAYVELL EDPDLIFFLK
        EGDQWAPIPE DQYLARLQQ L RQQIHTEFF SNLSFQHEN YKYEMVSSFQ HSIKMOVFTP
        KNGHICKMVY DKNIRIFKAL YNEYVTSVIG FFRGLKLLLL NIFVIDDRGM IGKNYFQLLD
        DKYAPISVQG YVATIPKLD FAEPYHPIIL DISDIDYVNF YLGDATYHDP GFKIVPKTPQ
        CITKVV D GNE VIYESSNPSV ECVYKVTYYD KKNE SMLRLD LNHSPPSYTS YYAKREGVWV
        TSTYIDLEEK IEELQDHRST ELDVMFMSDK DLNVVPLTNG NLEYFMVTPK PHRDIIIVFD
        GSEVLYYYEG LENHLVCTWI YVTGAPRLV HLRVKDIRPQ NTDIYMVKFG EYWRVRSKTQ
        YTQEIKLIK KSKKKLPSIE EEDSDKHGGP PKGPEPPTGP GHSSSESKEH EDSKESKEPK
        EHGSPKETKE GEVTKKPGPA KEHKPSKIPV YTKRPEFFPK SKSPKRPESP KSPKRPVSPQ
        RVPSPKSPKR PESLDIPKSP KRPE SPKSPK RVPSPQRPVS PRRPESPKSP KSPKSPKSPK
        VPFDPKFKEK LYDSYLDKAA KTKETVTLPP VLPDTDESFT TPIGEPTAEQ PDDIEPIEES
        VFIKETGILT EEVKTEDT IHS ETGEPEEPKR PDSPTKHSK PGATGTHPSMPK KRRRS DGLAL
        STTDLSEAG RILRDPTGKI VTMKRSK SFD DLTTVREKEH MGAEIRKIVV DDDGTEADDE
        DTHPSKEKHL STVRRRRPRP KKSSKSKSPR KPDSAFVPSI IFIFVLVLIV GIL

```

The above record contains the fields ID, AC, DT, DE, GN, OS and SQ. The field SQ contains sequence of the protein and does not have leading 'SQ' for the lines containing the actual sequence. The sequence of this protein (ID=104K SHEAN) and the record are terminated by '//'.
 104K SHEAN

Nasdaq: Each line is a record and fields are separated by commas. There are no missing fields. The first line gives names of various indices. Each subsequent line is the corresponding index on various days. The first field, for example, is the 'Date'.

1. Print the IDs of all the proteins in `sprot.txt`
2. Print the scientific names of all the organisms whose proteins have records. The output must be in sorted order. (Hint: You need to process the field `OS` and discard the information on strains. Use shell command to get an idea as in, `"grep ^OS sprot.txt | sort | uniq"`.)
3. Find the date on which the difference between the `N100` and `Financial100` is maximum.

Level 3

1. Print the IDs of all the proteins and the number of distinct amino acids in their sequences. (Each amino acid is represented by a single alphabet.)
2. Given the ID of the protein, print the number of times each amino acid occurs in the sequence.
3. Find the Nasdaq index that continued to grow for the longest time at a stretch.

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Assignment 8

Level 0

Implement all the examples for exception handling given in Balaguruswamy.

Level 1

1. Given the following class, write a program to construct and use class 'line' with method to find distance. Class line should also find the slope, but the slope should not be accessible to user (ie, should not be public)! You can have your own data members and methods under private, protected and other placed as indicated below, but the public members cannot be increased.

```
class line <fill anything here that may be necessary> {
    private:
        <fill anything here that may be necessary>
    protected:
        <fill anything here that may be necessary>
    public:
        int x;
        int y;
        int dist()
        {
            <fill anything here that may be necessary>
        }
};
```

2. Create the base class 'country' and derived classes 'monarchy' and 'democracy' with the following restrictions:

```
class country {
    public:
        int population;
        int area;
        int no_of_states;
};

class monarchy <fill anything here that may be necessary> {
    public:
        string king;
        string queen;
        string minister;
};

class democracy <fill anything here that may be necessary> {
    public:
        string president;
        string vice_president;
        string prime_minister;
};
```

Show how to use these to access all the members of the derived classes.

3. Consider the class 'movie' given below as a base class. Use it to construct two derived classes, 'bollywood' and 'hollywood'. Each has a data member 'certificate'. The values that can be accepted for certificate are 'U', 'U/A' and 'A' for bollywood and 'G', 'PG' and 'PG-13' for hollywood. User should be able to assign any of the above certificate to a movie but nothing else. If no valid certificate is available 'N/A' is to be the default value. Write a program that uses such classes.

Level 2

1. Create a derived class ind_mov that uses both democracy class and bollywood class. Show how to use it to get various information about India and its movies.

2. Create a derived class 'y_intercept' using class 'line' as a base class and the slope available in the 'line'. Given the two points, create a public method 'c' that returns the y-intercept.

3. Create two classes 'read' and 'copy' as shown below. Use them to open a given file name and copy it to another file. The file names are given by the user. Class 'copy' must inherit 'read' to complete its task. Is it necessary that 'read' class needs to be inherited to do the job even if it is mandatory to use 'read'?

```
class read {
    private:
        <fill anything here that may be necessary>
    protected:
        <fill anything here that may be necessary>
    public:
        string ip_file;
        void read_file(string fname) {
            <fill anything here that may be necessary>
        }
};

class copy : <fill anything here that may be necessary> {
    private:
        <fill anything here that may be necessary>
    protected:
        <fill anything here that may be necessary>
    public:
        string ip_file;
        void copy_file(string fname) {
            <fill anything here that may be necessary>
        }
};
```

4. Create class 'two_lines' using class 'line'. It should have a bool returning method 'if_intersect' that returns true if the two lines intersect and false otherwise.

5. Inheriting the class copy, create a class 'file_class' that can be used to create, append and overwrite files.

6. Create a class 'state' which have list of states in a country along with the information on the state capitol and population. Create a class from this called 'country' that holds the information about states of various countries.

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Assignment 9

Level 0

9.0.1. Class P has three private members (x, y, z) which are all integers. Write a program that implements the function Opt that will make $y=-(x+z)$ to a constant object of class P.

9.0.2. Set the values of the three coordinates of object of class P using another class as origin.

9.0.3. Using a class P2, extract the values of (x and y) from an object of class P.

Level 1

9.1.1. L1 and L2 are lists of integers with same size. Overload the operator '+' so that list $L3=L1+L2$ results in a list that is made by adding corresponding elements of the two lists.

Eg:

```
Input:
      L1: 1, 5
      L2: 2, 6, 8
Output:
      L3: 1, 5, 2, 6, 8
```

9.1.2. Let M1 and M2 be two maps. Overload the operator '+' so that map $M3=M1+M2$ results in addition of both maps resulting in a map with all the pairs in M1 and M2. You may assume no common keys between M1 and M2.

Eg:

```
Input:
      M1: <"k1", 10>, <"k2", 20>
      M2: <"k3", 30>, <"k4", 60>, <"k5", 70>
Output:
      M3: <"k1", 10>, <"k2", 20>, <"k3", 30>, <"k4", 60>, <"k5", 70>
```

9.1.3. Let M1 and M2 be two maps. Overload the operator '+' so that map $M3=M1+M2$ results in addition of both maps resulting in a map with all the pairs with common keys having values added.

Eg:

```
Input:
      M1: <"k1", 10>, <"k2", 20>
      M2: <"k1", 30>, <"k4", 60>, <"k5", 70>
Output:
      M3: <"k1", 40>, <"k2", 20>, <"k4", 60>, <"k5", 70>
```

Level 2

9.2.1. Create a class Matrix which stores a 2-d integers of a matrix with a dimension nxm. Overload operator '+' to add two matrices, each of which is an object of class Matrix.

9.2.2. Overload operator '+' to add a list and a vector to result in a list on the lines given in 9.1.1.

9.2.3. Create a class Matrix which stores a 2-d integers of a matrix with a dimension $n \times m$. Overload operator '*' to multiply two matrices, each of which is an object of class Matrix.

B.Tech. (I) - ICP-132
Assignment 10

Level 0

1. Let `ptr_i` be a pointer to an integer `'i'`. Show how to change the value of `'i'` using the pointer.
2. Print the address of `ptr_i` and `i` as given in the above example.
3. Print the address, value stored and the value stored at the pointed address for `ptr_i` using three different functions.

Level 1

1. Let `x` and `y` be two integers with values 10 and 20. Write a function `'swap'` that takes the address of these two integers and swaps their values.
2. Let `ptr_x` and `ptr_y` be the pointers to `x` and `y` as discussed above. Write a function `ptr_swap` that exchanges the address of these two pointers using references.
3. Let `ptr_x` and `ptr_y` be the pointers to `x` and `y` as discussed above. Write a function `ptr_swap` that exchanges the address of these two pointers using pointers.

Level 2

1. Let `A1` be a 1-dimensional array of size 10. Show how to store the first ten odd numbers in the array. Print these values with and without using their indices!
 2. Let `A2[4][4]` be a two-dimensional matrix such that `A[i][j]=(10*i)+j`. What values will be printed? Also write a function `mat_add` that adds two matrices of order 4x5. (See "Pointer Arithmetic and Multiple Indirection" at <http://www.technoplaza.net/programming/lesson9.php>)
- Code:

```
#include <iostream>

using namespace std;

int main()
{
    int A2[4][4];

    for (int i=0; i<4; i++) {
        for (int j=0; j<4; j++) {
            A2[i][j]=10*i+j;
        }
    }

    cout << *(A2+1) << endl;
    cout << *(* (A2+2)+3) << endl;

    return 0;
}
```

3. In the problem 1, A1 is itself a pointer. Let B1 be a pointer that is A1+5. Can one access an element B1-2? Show if it is allowed and find the values of *(A1+2) and *(B1-1).

4. Let A3[4][4][4] be a two-dimensional matrix such that A[i][j]=(10*i)+j. What values will be printed? (3-D arrays are pointer-of-pointers-of-pointers.)
Code:

```
#include <iostream>

using namespace std;

int main()
{
    int A3[4][4][4];

    for (int i=0; i<4; i++) {
        for (int j=0; j<4; j++) {
            for (int k=0; k<4; k++) {
                A3[i][j][k]=100*i+10*j+k;
            }
        }
    }

    cout << ***(A3+1) << endl;
    cout << **(*(A3+2)+3) << endl;
    cout << *(*(*(A3+2)+3)+1) << endl;

    return 0;
}
```

5. Let 'add' and 'mult' be two functions with same type of arguments. Demonstrate usage of switch and pointers to function by executing add to do something if a bool variable is true and mult if it is false.

6. Let 'add' and 'mult' be two functions with same type of arguments. Demonstrate usage of switch and pointers to function by executing add to do something if there are even number of 1s in the binary representation of an integer 'n' given as input and mult otherwise. (For instance, if 5 is stored as an integer and if integer has 4 bytes, then the binary representation could be 00000000 00000000 00000000 00000101. Here there are 2 ones and the rest 16 are zeros.

7. Demonstrate adding of two objects through overloading '+' using their pointers.

8. Write a program to add n objects of class C as above and connect them in the similar way. Print all the values of the objects using their pointers stored in another objects.

9. Connect an object of class P defined below to another object of the same class. Print the content of the second object (ob2) using the address stored in the first object (ob1). To do this, you may use the following code by completing the line with cout. Similarly demonstrate the same for a dynamically created object.

Code:

```
#include <iostream>

using namespace std;

class C {
public:
    int x;
    C *ptr_C;
};

int main()
{
    C *ob_ptr;

    C ob1;
    C ob2;

    ob2.x=10;
    ob1.ptr_C=&ob2;

    ob_ptr=new C; // create an object of type C
    (*ob_ptr).x=20; // set value of x as 20
    ob2.ptr_C=ob_ptr; // store the address of this object

    cout <complete this to print ob2.x using ob1>;
    cout <complete this to print x in object created using ob2>;

    return 0;
}
```