User Defined Types and Functions

6.1 Objectives

1. To represent the given problems using Structures/Unions/Enumerations and their arrays.
2. To familiarize the computation using Structures, Unions, Enumerations and functions.

Time-span: 2 lab days (4 hrs.)

6.2 Problems

1. Nepal Technical University teaches only three subjects in their special vocational program. The following 2-Dimensions table describes the result of the internal examination of 5 students.

CRN	Name	Programming	Math's	Physics
301	Hari Kunwar	45	60	36
302	Manita Lama	52	15	65
303	Puskar Shah	78	85	79
304	Usha Karki	48	45	45
305	Bikash Rajat	92	95	98

Write a computer program in C for the following:
(a) Represent the students and their associated marks using array of Structure.
(b) Assume, the pass percentage is 45%, write a function to count the number of students failing in each subjects.
(c) Given the following result categories (Division), i. Less than 45%: Fail, ii. Above 45%: Pass, iii. Above 50%: Second Division, iv. Above 75%: First Division and v. Above 90%: Distinction.
Write a C function that takes an input of CRN of the student and displays the result category (division) of the student.
d. Write a C function to answer, who is the topper in "Programming"?

2. Nepal Hawaijahaj Company is an airlines company with the ticket rates between different cities as described by figure 6.1.

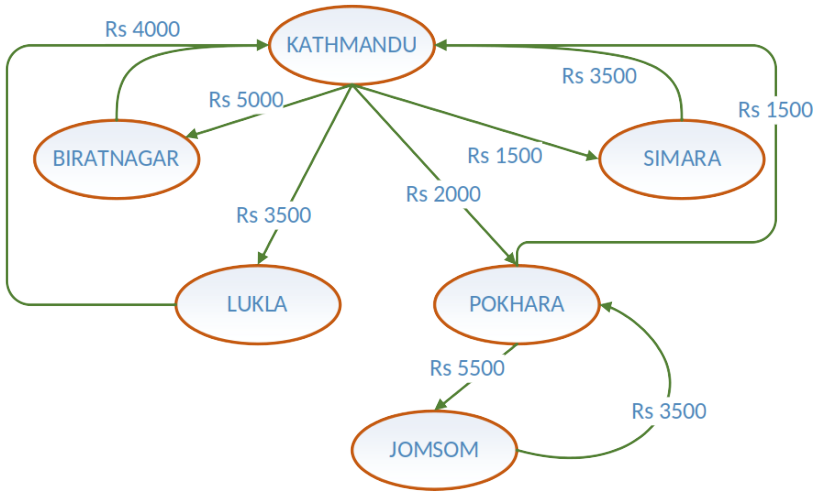

Fig. 6.1 Flight ticket rates of Nepal Hawaijahaj Company.

a. Represent the fares from the given path using array of structures.

b. Considering the direct flights only, With the given input of two city names from the console, display the associated fare if the path exists

between them otherwise display the message “Flight not available”.

3. A person has two types of addresses, the first one is PostalAddress and the second one is of Text type(i.e. represented in a line text). PostalAddress has multiple fields such as country, district, municipality and so on (assume all the fields based on your local address). Text address are the formatted string represented in the line text and are used for printing in the envelopes. For example: Sitamadhi Gaunpalika – 2, Tamghare Tole, Nawalparashi, Nepal.

   a. In your C program, represent both addresses using a union type for a PersonAddress.

   b. Create an array of 5 persons and initialize it with dummy data.

   c. Write C codes to display all the address that belongs to the same district name. Take input of the district name from the console.

   d. Display all the formatted text addresses in the console output.

4. A family comprises husband and wife, a new couple. Both are quite occupied due to their official job and have got agreement to visit market for kitchen demands. Write a program to toss a coin with outcome HEAD(means wife should visit market) and TAIL(means husband should visit market). Design the coin toss experiment such that 70% of time should occur HEAD and 30% of time should occur TAIL.

   In your program, take input from console such that a weekday 0 for Sunday, 1 for Monday and so on and the output looks like:


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Toss for >>  Sunday
Output: TAIL [Today is Sunday, husband's turn.]
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[Hint: use enum for tossing outcome and week days. For random output use rand() function from <stdlib.h> and period(%) operator]

5. This question asks to combine the use of structures together with functions.
   (a) Write a structure to represent a vector in the three dimensional Euclidean space.
   (b) Write separate functions for reading and printing structure type variables as defined in question (a).
   (c) Write a function that calculates the magnitude of a vector. Your function should take the structure type defined in question (a) as the argument.
   (d) Write a function that calculates the dot product of two vectors.
   (e) Given two vectors $\vec{x}$ and $\vec{y}$, the angle between them can be calculated as –

$$\theta = \cos^{-1}\left(\frac{\vec{x}\,.\,\vec{y}}{|\vec{x}|\,.\,\overrightarrow{|y|}}\right)$$

   Write a function that takes two vectors as argument and returns the angle between them.

   (f) Write a program to read 10 vectors and determine which has least angle with the x-axis.

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