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## Programming Fundamentals (CS 1002)

### Cybersecurity Department

### Fall 2022 ASSIGNMENT # 2

**Due Date: Sunday, October 16, 2022 (05:59 pm)**

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### Instructions

1. Assignments are to be done individually. You must complete this assignment by yourself. You cannot work with anyone else in the class or with someone outside of the class. The code you write must be your own and you must understand each part of your code. You are encouraged to get help from the instructional staff through google classroom/Piazza.
2. Use appropriate data types and operations for each problem. You cannot use advanced topics not covered so far.
3. Your code must be **generic** i.e. it should work for different inputs where inputs are required.
4. The output should be properly displayed and well presented. **5% marks will be deducted in each question if appropriate comments and indentation** not done in source code.
5. **Plagiarism:** Plagiarism of any kind (copying from others, copying from the internet, etc) is not allowed. **If found plagiarized, you will be awarded zero marks** in the assignment. Repeating such an act can lead to strict disciplinary actions and failure in the course.
6. **Submission Guidelines:** Dear students, we will be using auto-grading tools, so **failure to submit according to the below format would result in zero marks** in the relevant evaluation instrument.
  - a. Run and test your program on a lab machine before submission. If there is a **syntax error, zero marks** will be awarded in that specific question.
  - b. For each question in your assignment, make a separate .cpp file e.g. for question 1, make **ROLL-NUM\_SECTION\_q1.cpp**, and so on (e.g. **22i-0001\_A\_q1.cpp**, **22i-0001\_A\_q2.cpp**, **22i-0001\_A\_q3.cpp** and so on).
  - c. In every .cpp file that you create (every question), you must write your name, student-id, and assignment # on the top of the file in the comments.
  - d. Combine all your work (all questions files) in one folder. The folder must contain **only .cpp files** (no binaries, no exe files etc.). If we unable to download your submission due to any reason you will be awarded zero mark.
  - e. Rename the folder as **ROLL-NUM\_SECTION** (e.g. 22i-0001\_A) and compress the folder as a zip file. (e.g. **22i-0001\_A.zip**). Only zip file will be acceptable.
  - f. Submit the .zip file on Google Classroom within the deadline. Make sure that you have submitted the correct file.
  - g. Submission other than Google classroom (e.g. email etc.) will not be accepted.
  - h. The student is solely responsible to check the final zip files for issues like corrupt files, viruses in the file, mistakenly exe sent. If we cannot download the file from Google classroom due to any reason it will lead to zero marks in the assignment.
7. **Late submission:** **10% marks will be deducted for every hour of late submission**, i.e. assignments submitted 10 hours late will get zero marks. 10% will be deducted with the start of hour so both submissions on 10:01 and 10:59 will get same deduction of 10%.



### Problem 1:

Consider the following scenario. Total capacity of Tarbela dam is 1550 feet. The water level in Tarbela dam increases at a rate of 150 feet per month from March to August; and decreases at a rate of 200 feet per month from September to February. Assume that the water level in August 2022 is 1500 feet. In which month of what year the dam will reach level 0 or to its maximum capacity? Write a program to find out. Your program should take following inputs:

- Current water level
- Current month
- Current Year
- Rate of decrease in level from September to February
- Rate of increase in level from March to August.

Output should be like:

- The dam will reach zero level in 11-2024

or

- The dam will reach its maximum capacity in 04-2025

### Problem 2:

Write a program that displays the following menu:

#### **Geometry Calculator**

1. Calculate the Area of a Circle
2. Calculate the Area of a Rectangle
3. Calculate the Area of a Triangle
4. Quit

Enter your choice (1-4):

If the user enters 1, the program should ask for the radius of the circle and then display its area. Use the following formula:  $\text{area} = \pi r^2$  Use 3.14159 for  $\pi$  and the radius of the circle for  $r$ .

If the user enters 2, the program should ask for the length and width of the rectangle and then display the rectangle's area. Use the following formula:  $\text{area} = \text{length} * \text{width}$

If the user enters 3 the program should ask for the length of the triangle's base and its height, and then display its area. Use the following formula:  $\text{area} = \text{base} * \text{height} * .5$

If the user enters 4, the program should end.

**Input Validation:** Display an error message if the user enters a number outside the range of 1 through 4 when selecting an item from the menu. Do not accept negative values for the circle's radius, the rectangle's length or width, or the triangle's base or height.

### Problem 3:

Write C++ program **USING SWITCH STATEMENT** that plays the game of "Rock, paper, scissors." In this game, two players simultaneously say (or display a hand symbol



representing) either "rock," "paper," or "scissors." The winner is the one whose choice dominates the other. The rules are: paper dominates (wraps) rock, rock dominates (breaks) scissors, and scissors dominate (cut) paper. Declares and initializes First player and second player variables at the start).

You can use 1=rock, 2=paper,3=scissors

**Examples:**

First player = 1, second player = 1

Sample Output: Draw

First player = 1, second player = 2

Sample Output: 2nd player wins

**Problem 4:**

Write a program that asks for the number of calories and fat grams in a food. The program should display the percentage of calories that come from fat. If the calories from fat are less than 30% of the total calories of the food, it should also display a message indicating that the food is low in fat.

- One gram of fat has 9 calories, so
- Calories from fat = fat grams \* 9
- The percentage of calories from fat can be calculated as
- Calories from fat ÷ total calories

**Problem 5:**

Write a C++ program that gives the largest number using ternary operator among:

Three Numbers that is if three numbers are taken as input form user.

Four Numbers that is if three numbers are taken as input form user.

**Problem 6:** Write a code that takes two integers as input representing a month and day and prints the season for that month and day. Assume that months are specified as an integer between 1 and 12 (1 for January, 2 for February, and so on) and that the day of the month is a number between 1 and 31. If the date falls between 16/12 and 15/3, you should print "Winter". If the date falls between 16/3 and 15/6, you should print "Spring". If the date falls between 16/6 and 15/9, you should print "Summer". And if the date falls between 16/9 and 15/12, you should print "Fall".

**Problem 7:** A certain grade of steel is graded according to the following conditions:

- (i) Hardness must be greater than 50
- (ii) Carbon content must be less than 0.7



(iii) Tensile strength must be greater than 5600

The grades are as follows:

Grade is 10 if all three conditions are met.

Grade is 9 if conditions (i) and (ii) are met.

Grade is 8 if conditions (ii) and (iii) are met.

Grade is 7 if conditions (i) and (iii) are met.

Grade is 6 if only one condition is met.

Grade is 5 if none of the conditions are met.

Write a program, which will require the user to give values of hardness, carbon content and tensile strength of the steel under consideration and output the grade of the steel.

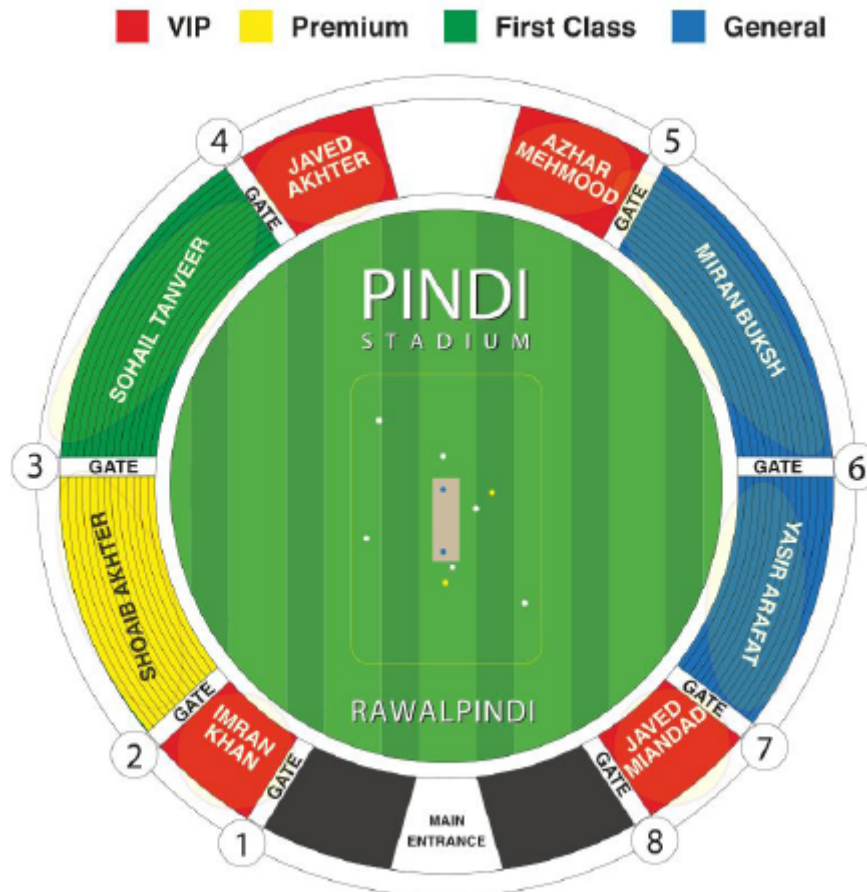
**Problem 8:**

You are given a grid as shown in the figure below. You can determine the color and number of each square from the grid. Using switch write a C++ program that inputs two numbers within the grid range. Your program will determine if the two squares entered in this grid have the same color or not.

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36

### Problem 9:

Write a C++ program for a company that is planning to sell e-tickets for PSL-5 matches being held in Rawalpindi Cricket Stadium (RCS). The map of the seating enclosures is shown below.



Each of the enclosures has the following maximum capacity:

- Imran Khan enclosure: Max 1000 seats.
- Javed Miandad enclosure: Max 1000 seats.
- Javed Akhter enclosure: Max 1000 seats.
- Azhar Mehmood enclosure: Max 1000 seats.
- Sohail Tanveer enclosure: Max 3000 seats.
- Shoaib Akhtar enclosure: Max 3000 seats.
- Imran Buksh enclosure: Max 2500 seats.
- Yasir Arafat enclosure: Max 2500 seats.

Here is the list of all ticket prices for night matches in Rawalpindi Cricket Stadium.

- 27 February 2020 | Islamabad United v Quetta Gladiators (7 pm-10.15 pm)  
(VIP – Rs. 3000, Premium – Rs. 1500, First-class – Rs. 1000, General – Rs. 500)



- 28 February 2020 | Peshawar Zalmi v Lahore Qalandars (7 pm-10.15 pm)  
(VIP – Rs. 3000, Premium – Rs. 1500, First-class – Rs. 1000, General – Rs. 500)
- 29 February 2020 | Islamabad United v Peshawar Zalmi (7 pm-10.15 pm)  
(VIP – Rs. 3000, Premium – Rs. 1500, First-class – Rs. 1000, General – Rs. 500)
- 1 March 2020 | Islamabad United v Karachi Kings (7 pm-10.15 pm)  
(VIP – Rs. 2000, Premium – Rs. 1000, First-class – Rs. 500, General – Rs. 250)
- 2 March 2020 | Peshawar Zalmi v Karachi Kings (7 pm-10.15 pm)  
(VIP – Rs. 1500, Premium – Rs. 1000, First-class – Rs. 500, General – Rs. 250)
- 5 March 2020 | Peshawar Zalmi v Quetta Gladiators (7 pm-10.15 pm)  
(VIP – Rs. 1500, Premium – Rs. 1000, First-class – Rs. 500, General – Rs. 250)

Here is the list of all ticket prices for day matches in Rawalpindi Cricket Stadium.

- 7 March 2020 | Peshawar Zalmi v Islamabad United (2 pm-5.15 pm)  
(VIP – Rs. 2000, Premium – Rs. 1000, First-class – Rs. 500, General – Rs. 250)
- 8 March 2020 | Multan Sultans v Islamabad United (2 pm-5.15 pm)  
(VIP – Rs. 1500, Premium – Rs. 1000, First-class – Rs. 500, General – Rs. 250)

The program should start by displaying a menu listing the schedule of matches in the stadium.

1. 27 Feb 2020 – Islamabad United v Quetta Gladiators, Pindi Cricket Stadium  
(7pm-10.15pm)
2. 28 Feb 2020 – Peshawar Zalmi v Lahore Qalandars, Pindi Cricket Stadium  
(8pm-11.15pm)
3. 29 Feb 2020 – Islamabad United v Peshawar Zalmi, Pindi Cricket Stadium  
(7pm-10.15pm)
4. 1 Mar 2020 – Islamabad United v Karachi Kings, Pindi Cricket Stadium  
(7pm-10.15pm)
5. 2 Mar 2020 – Peshawar Zalmi v Karachi Kings, Pindi Cricket Stadium  
(7pm-10.15pm)
6. 5 Mar 2020 – Peshawar Zalmi v Quetta Gladiators, Pindi Cricket Stadium  
(7pm-10.15pm)
7. 7 Mar 2020 – Peshawar Zalmi v Islamabad United, Pindi Cricket Stadium  
(2pm-5.15pm)
8. 8 Mar 2020 – Multan Sultans v Islamabad United, Pindi Cricket Stadium  
(2pm-5.15pm)

Enter your choice (1 - 8)

When a user selects one of the above options, a sub-menu is shown listing names of all the enclosures, their class, ticket price and number of seats available . The available seats are randomly generated for each enclosure within its range of maximum capacity. When the user selects one of the enclosures in the sub-menu, the programs prompts the user if he/she





wishes to buy tickets for a family. In case, the family option is selected - the user is prompted to enter the required number of adult and children tickets, his/her CNIC number (maximum 4 adults, and 5 children). If the family option is not selected, the user is prompted to enter the required number of adult tickets, his/her CNIC number (maximum 8 adults). To attract more spectators, the company is giving discounts for groups and children. If the user selects family option or enters adult tickets greater than four, 10% rebate is given on all adult tickets. A child ticket is given 20% rebate. The program finally displays the total amount due.

You have to write this program using **switch** statements primarily. Hint: For one and two-way selections (e.g. input validations), you are allowed (and encouraged) to use if statements.

**Input Validation:** Make sure the user cannot select invalid options in the menu and that the number of people is always greater than 0. Similarly, a user cannot enter more than available tickets for the chosen option. For family option, the number of children needs to be always greater than one.

### Problem 10:

Using Nested Switch statement, write a program that displays the following menu for the food items available to take order from the customer:

- B= Burger
- F= French Fries
- P= Pizza
- S= Sandwiches

After taking inputs for food item your program will ask four different categories for each food item for example if user press B for Burger it will display following menu:

- Burger 1 Rs. 200 = 1
- Burger 2 Rs. 250 = 2
- Burger 3 Rs. 300 = 3
- Burger 4 Rs. 350 = 4

Similar menu will be open for other food, Items (Think cleverly).

After taking inputs the food items and food, category your program will ask quantity of food item for a particular category required. For example, if user press B for Burger 1 it will display following menu:

- For 1 Burger = A
- For 2 Burgers = B
- For 4 Burgers = C



Similar menu will be open for other food Categories.

After taking all inputs from user your program must calculate appropriate bill for a user.

For example, if user enters B for Food Item 2 for food category and C for 4 burgers it will displays bill as:

**Your total bill is = 1400 RS**

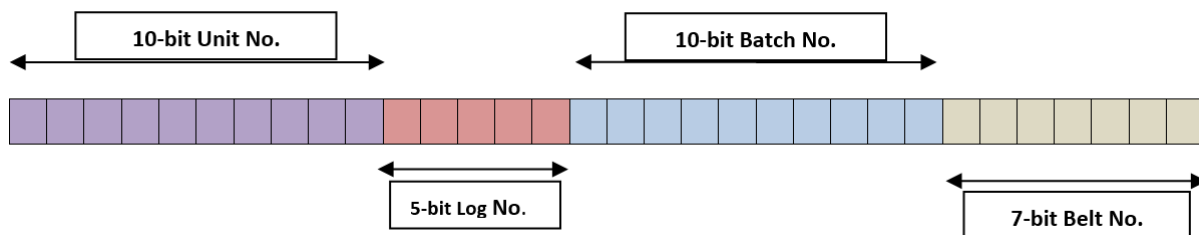
For problem 11 and 12 use bitwise operators along with appropriate selection structure.

### Problem 11:

In a Military database system, IDs of the army personnel are stored in a 32-bit value, which is coded as follows:

- a. 7-bits Belt number
- b. 10-bits Batch number
- c. 5-bits Log number
- d. 10-bits Unit number

And stored in following format:



Your Task is to write a C++ Program which inputs a four-byte integer ID, and a string Name of the army man. Your Program will separate the Belt number, Batch number, Log number and Unit number and prints the information in the following manner.

```
Enter Name of Army Man: Abdullah Khan
Enter ID of Army Man: 858993459

Belt number of Abdullah Khan is :    51
Batch number of Abdullah Khan is:    614
Log number  of Abdullah Khan is:     25
Unit number of Abdullah Khan is:     204
```

### Problem 12:





In a computing system (FAST-MAC), a machine level instruction is represented in a 16-bit value, which is further divided into three subparts.

- 4-bit Operation code (Most Significant bits)
- 6-bit Left Operand (Middle bits)
- 6-bit Right Operand (Least significant bits)

And stored in following format:

<b>4-bit opcode</b>	<b>6-bit Left Operand</b>	<b>6-bit Right Operand</b>
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Four-bit operation code (**opcode**) of FAST-MAC can define following 16 operations:

<u>Decimal Code</u>	<u>Binary Code</u>	<u>Operation Description</u>
0	0000	Display Value of Right Operand
1	0001	Display Value of Left Operand
2	0010	Take (6-bit) Random input in Right operand
3	0011	Take (6-bit) Random input in Left operand
4	0100	Add Left and Right operand
5	0101	Calculate Subtraction of operands (Subtract Smaller from Larger)
6	0110	Multiply Left and Right operand
7	0111	Calculate division of operands (Divide Larger from smaller)
8	1000	Calculate remainder operands (Larger from smaller)
9	1001	Bitwise OR of Left and Right operand
10	1010	Bitwise AND of Left and Right operand
11	1011	Bitwise XOR of Left and Right operand
12	1100	Complement of Right
13	1101	Complement of Left
14	1110	Left Operand << Right Operand
15	1111	Left Operand >> Right Operand

Write complete C++ program that implements FAST-MAC using appropriate data types and operators. Your program should get a two-byte input from user and then perform the operation as per FAST-MAC. The output to show what operation was performed and on what operand values. The result of the operation should also be displayed.