PIC 10A 2B

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Today…

- 2-D Vectors
- Classes
- Exercise on Classes + 2-D Vectors: the **MATRIX** class
- HW6 Questions?

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2-D Vectors

- A vector of vectors is called a 2-D vectors, because it looks like a 2-D array if you visualize it

v is a vector of vectors, where

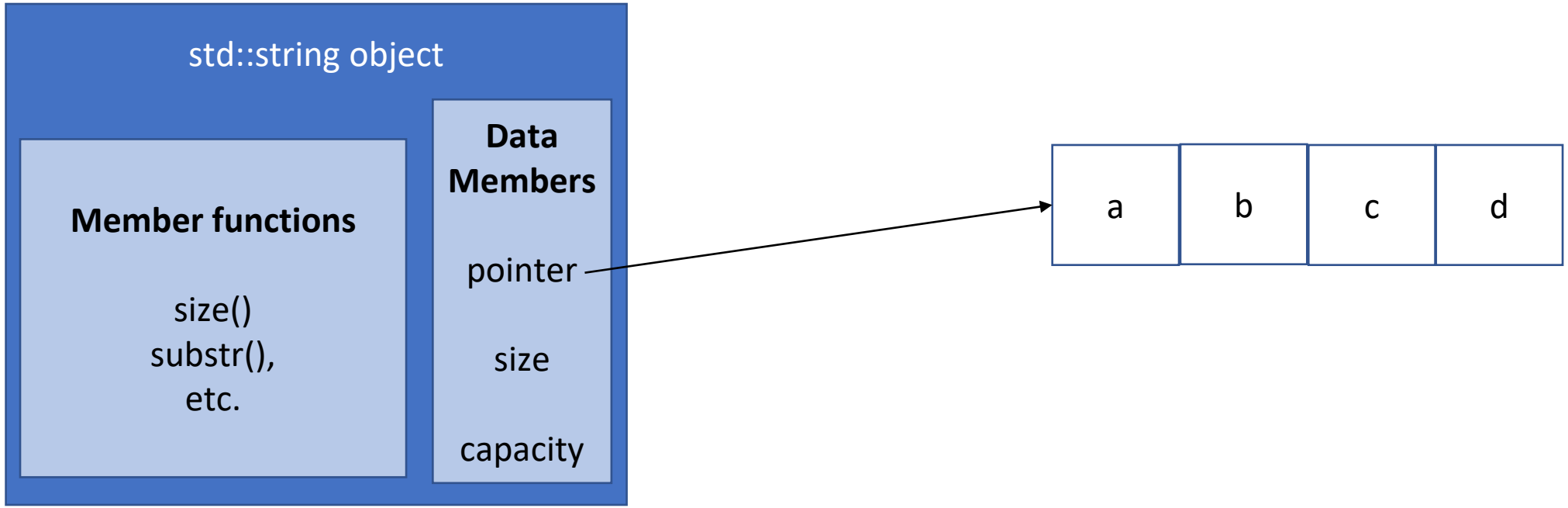
- v[0] is a vector of length 3
- v[1] has length 5
- v[2] has length 4
- v[3] has length 2
- …

C++ Classes

Concepts, Examples, and Exercise Problems

Classes

- Roughly speaking, a class is a user-defined type that contains a collection of data members with other features (methods)
- e.g. “std::string” has data members like
  - the pointer to the char array (actual string data)
  - size and capacity variables, and some other members
  - useful member functions like size(), substr(), and operators([], ==, <, +, etc.)



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Classes

- Default accessibility of data members/functions is *private* for classes
  - On the other hand, a very similar data structure, “struct” has *public* members by default

- To access the members, use the “.”(dot) operator

```
e.g.    string str = "ABCDE";
        int len = str.length();
```

- Initialization is done by a “constructor”

```
class B {
public:
    void b() const;
    B();
};
```

```
int main() {
    B b_object;
}
```

Calling the default constructor here

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Classes

- If a class has several data members, a proper initialization may be important

```
class B {
public:
    string name;
    double salary;
    int age;
    void b() const;
    B();
    //(another c'tor)
};
```

```
int main() {
    B b_object;
    B John("John Doe", 60000, 25);
}
```

Calling the default constructor here.
Setting the name = “”, salary = 0.0 and age = 0 in the default constructor can be a good initialization

Calling another type of constructor here
(not declared in the class interface yet)

What’s the correct signature of this constructor?

```
B(string _name, double _salary, int _age);
```

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Classes

- Always use the ***constructor initializer list*** for initialization

```
class B {
public:
    string name;
    double salary;
    int age;
    void b() const;
    B();
};
```

```
B(string _name, double _salary, int _age)
     : name(_name), salary(_salary), age(_age) {}
```

```
int main() {
    B b_object;
    B John("John Doe", 60000, 25);
}
```

The constructor's **body** is empty in this case

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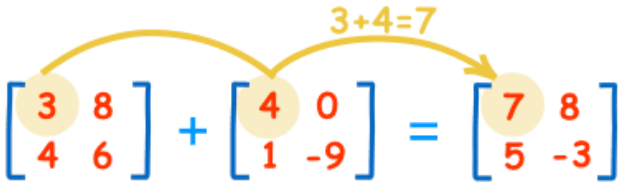
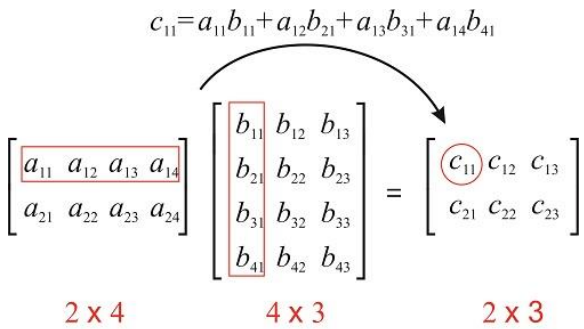
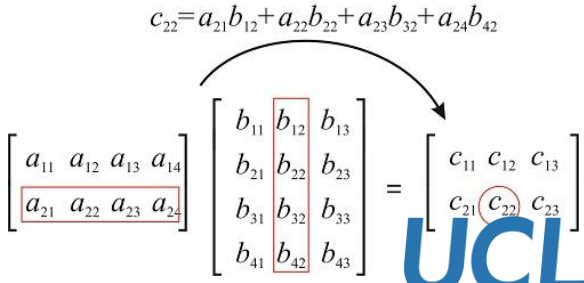
“Matrix” Class

- We implement a class “Matrix” to handle matrices (mathematical objects)
- Each matrix has the following member variables
  - number of rows
  - number of columns
  - 2-D vector for storing the entries
- And the following member functions
  - A.size(): returns the dimension as a vector of length two (nRows, nCols)
  - A.at(i, j): returns the reference of the element at (i-th row and j-th column)
  - A.isEqualDim(B): check if the dimensions of A and B are the same
  - A.add(B): adds A and B and return the sum A+B
  - A.subtract(B): returns A-B
  - A.scalarMultiplication(c): returns cA, where c is a scalar and A is a matrix
  - A.multiplication(B): returns AB (matrix multiplication)
  - A.transpose(): transposes the matrix (does not return anything)
  - A.print(): prints the matrix on the console
- Constructors accepting the dimension (default: 1x1, filled with 0)

$$\begin{array}{c|cccc} & 1 & 2 & \cdots & n \\ \hline 1 & a_{11} & a_{12} & \cdots & a_{1n} \\ 2 & a_{21} & a_{22} & \cdots & a_{2n} \\ 3 & a_{31} & a_{32} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ m & a_{m1} & a_{m2} & \cdots & a_{mn} \end{array}$$







HW6 Questions?

- 1. Transform a vector (input) to a 2-D vector
- 2. Print the 2-D vector
- 3. check the row-sums, the column-sums, and the diagonal-sums
  - It should be 34 = (1+2+…+16)/4
  - If any of the sums is not equal to 34, it is not a magic square

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Your Feedback is welcome

- Don’t hesitate to give a feedback on the discussion
- Use the link on my Github repo, or the link below:
  - https://forms.gle/erZj1iSgHNrHQuXk6

My Github repo on the web looks like:

code	Week2 Tu
LICENSE	Initial commit
README.md	Update README.md

README.md

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PIC10A discussion 2B, UCLA for Fall 2022

Google form link for feedbacks: https://forms.gle/erZj1iSgHNrHQuXk6

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