

Ph/CS 265 Lecture 01. Introduction.

The purpose of this lecture is to introduce you to the subject of scientific computing. The lecture will be focused on the following concepts:

- The purpose of scientific computing.
- What you need to know about the computer. Relationship between hardware, operating system, and programming languages. Types of programming languages.
 - Your accounts
 - Starting Maple
- Maple worksheet structure.
 - Text and expressions
 - Active and passive expressions
 - Arithmetics; rules of precedence.
 - Constants and variables
 - Expression format
 - Quotes and their purposes

The area of computational physics is has recently established itself as an independent branch of modern science, and is widely used to complement and direct both theory and experiment. However, before we begin to study scientific computing, we have to spend some time to understand the basics of human-computer interaction. The most basic principle that one has to keep in mind is the following:

While computers are very powerful in number-crunching, they are not intelligent. Meaning – the computation scientist is the "brain" behind any computation. He or she is always in charge – and it is his/her responsibility to direct computer to the final answer.

All computers follow the same principles. Deep inside they have the memory to store numbers processor to operate these numbers. Processors are able to complete a fixed set of commands – machine instructions. These include reading a number from a memory location, storing a number to a memory location, adding or multiplying two numbers, ect. Luckily, we rarely have to use the machine instructions. To simplify the life of computation scientist the operating system and other programs can convert a set of "user-friendly" instructions into machine ones.

Each of you has its own *account*, where you can store your personal data. To load your data to a computer, you have to *log in* into your account. Your username is same as your ONID username. Your password is your *username#*. You have to change your password first time you log in (*pw*). You then can create folders, change the active folder (where the data is stored), and run programs, such as Maple, Java, or others. To start Maple in Unix, open the command prompt and type *xmaple*. On Windows, click on Maple icon.

Maple has two basic modes: *text mode* and *execution* one. In the text mode, Maple is used much like a text processor, like Word. In execution mode, Maple computes *expressions*. An *expression* is anything that can be evaluated to a number, for example, $5, 5+4$, etc. Expression always ends with semicolon.

Maple always calculates expressions left-to-right, and computes power (^) before multiplication and division (*, /), followed by addition or subtraction (+,-). This default order of computation can be modified with use of parentheses.

The result of an expression can be stored into a *variable*, and later be reused to calculate other expressions. To calculate a sum, use a command *sum(expression, index_var=start_val..end_val)*.

Quotes can be used to postpone computations or format expressions ('...'), introduce some text ("..."), and suppress the computation (`...`). The latter format can be also used to introduce *variable names* that contain special symbols.