

جامعة دمشق
كلية الهندسة المدنية

مادة البرمجة
السنة الثالثة

5/4/2023

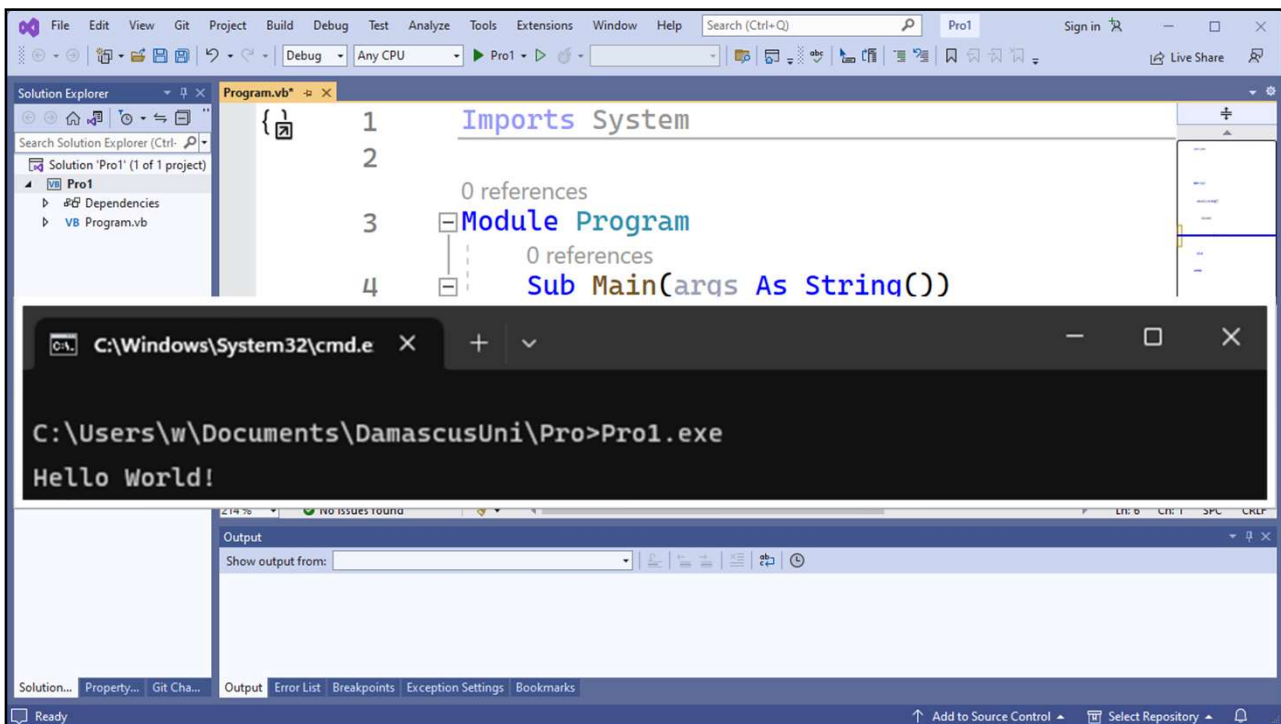
Wael Darwich

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Hello World! Visual Basic

```
Imports System
Module Program
    Sub Main(args As String())
        ' Hello World! Comment with apostrophe
        Console.WriteLine("Hello World!") ' Write line
    End Sub
End Module
```

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Content

- Memory and Variables
- Variables
 - Type
 - Name
 - X Æ A-12
 - X Æ A-XII
 - Size
- Assignment
- Operators
 - Precedence of Operators
- Subroutine
 - Example

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Example

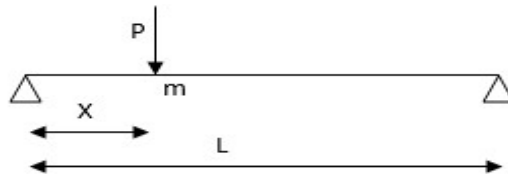
- Calculate reactions and bending moment

- Input:

- L, x, P (real numbers)
- S_L, S_R

- Output:

- R_L, R_R, m



Variables

- Reserved locations in memory

- Names:

- Including a-z, A-Z, 0-9, _ (underscore)
- Starting a-z, A-Z, _
- No space `section_radius`
- CamelCase: `SectionRadius`
- Case insensitive
 - $A = 1, a = 2$
 - Same variable
- Meaningful name: `length, width` instead of `myVar`

Variable Types

- Boolean: True / False
- Numbers
 - Integers, e.g., counter
 - Decimals
- Strings "Text"
- ...

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Booleans in Memory



- 1 Byte = 8 Bit
- Could be single byte, or more
 - Packing

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DoF Booleans

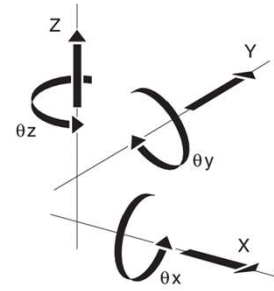
- 2D translation: 2 Booleans
- 3D translation: 3 Booleans
- 3D translation + rotation: 6 Booleans

	Tx	Ty	Tz	Rx	Ry	Rz
Free						
	✓	✓				
	✓	✓				✓

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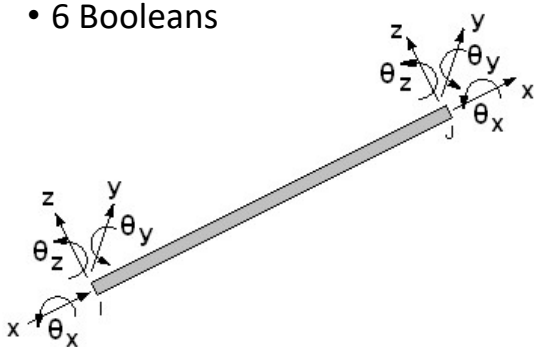
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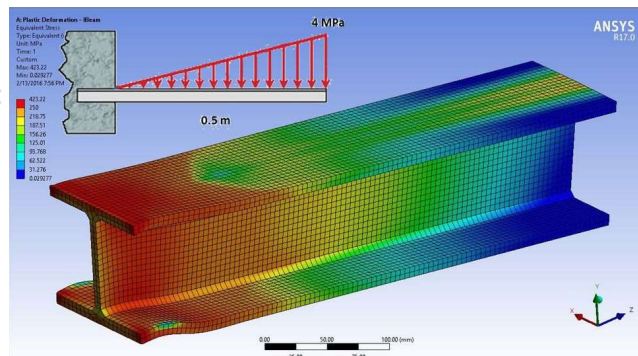
9

DoF Booleans

- 6 Booleans



2 Nodes, 12 Byte



200k Nodes, 1.2 M Byte

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Number of Combinations

```

0  000000 10  001010 20  010100 30  011110 40  101000 50  110010 60  111100
1  000001 11  001011 21  010101 31  011111 41  101001 51  110011 61  111101
2  000010 12  001100 22  010110 32  100000 42  101010 52  110100 62  111110
3  000011 13  001101 23  010111 33  100001 43  101011 53  110101 63  111111
4  000100 14  001110 24  011000 34  100010 44  101100 54  110110
5  000101 15  001111 25  011001 35  100011 45  101101 55  110111
6  000110 16  010000 26  011010 36  100100 46  101110 56  111000
7  000111 17  010001 27  011011 37  100101 47  101111 57  111001
8  001000 18  010010 28  011100 38  100110 48  110000 58  111010
9  001001 19  010011 29  011101 39  100111 49  110001 59  111011

```

Number of Combinations

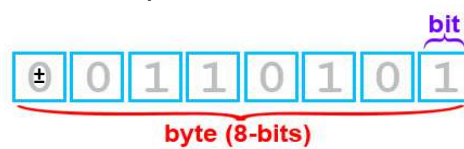
- 3D translation + rotation: 6 Booleans per node
- Array of 6 Booleans
- (True / False)⁶
- $2^6 = 64$
- Less than a byte ($2^8 = 256$)
- 1 Byte per node (0-255)
- Less memory
- Same data

Char

- 2 Bytes Unicode
- Single character

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Integers in Memory



- 1 Byte variable
 - Unsigned Integer 0 to 255 ($2^8=256$)
1111 1111 Bin = 255 Dec
 - Signed integer -128 to 127 ($2^7=128$)
111 1111 Bin = 127 Dec

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Integers in Memory

0 0 1 1 0 1 0 1 0 0 1 1 0 1 0 1

- 2 Byte integer (short)
 - Unsigned short 0 to 65535 ($2^{16}=65536$)
 - Signed short -32768 to 32767 ($2^{15}=32768$)

Integers in Memory

- Unsigned Short
- Unsigned Integer
- Unsigned Long
- Short
- Integer
- Long

Decimals in Memory

- Floating Point

123456789.123456789

Scientific Notation

- The Earth's mass is about:

5972400000000000000000000.0 kg

- In scientific notation:

5.9724×10^{24} kg

- In E (Exp) notation:

5.9724**E**24 kg

- An electron's mass is about

0.0000000000000000000000000000000910938356 kg

9.10938356**E**-31 kg

Memory Limitations

- Single variable for large and small numbers with high precision:

$$5.9724E+24 + 9.10938356E-31$$

$$L = 5.9724E+24$$

$$S = 9.10938356E-31$$

$$R1 = L + S$$

$$R2 = R1 - L$$

$$R2 = L + S - L = S ?$$

$$R2 = 0$$

- Select appropriate coordinate system

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Decimals in Memory

Double precision	0100000000001001001000011111101101010100010001000010110100011000
Single precision	01000000010010010000111111011011

64bit = double, double precision



32bit = float, single precision



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Variable Types

Type	Size	Min	Max
Boolean	Depends!	False	True
Byte	1 byte	0	$255 = 2^8 - 1$
Char	2 bytes	0	$65,535 = 2^{16} - 1$
UShort	2 bytes	0	65,535
UInteger	4 bytes	0	4,294,967,295
ULong	8 bytes	0	18,446,744,073,709,551,615
Integer	4 bytes	-2,147,483,648	2,147,483,647
Long	8 bytes	-9,223,372,036,854,775,808	9,223,372,036,854,775,807
Single	4 bytes	-3.4028235E+38 1.401298E-45	-1.401298E-45 3.4028235E+38
Double	8 bytes	-1.79769313486231570E+308 4.94065645841246544E-324	4.94065645841246544E-324 1.79769313486231570E+308

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Variable Types

- [Data Type Summary - Visual Basic | Microsoft Learn:](https://learn.microsoft.com/en-us/dotnet/visual-basic/language-reference/data-types/)

<https://learn.microsoft.com/en-us/dotnet/visual-basic/language-reference/data-types/>

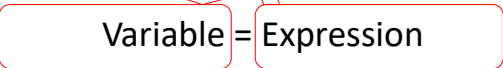
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Operators

- Assignments operator =
- `Counter = 123`
- 
- `Counter = Counter + 1`
- `Counter + 1 = 2`
- Assignments vs. Equal
 - `Counter = Counter + 1`
 - `0 = 0 + 1`
- Arithmetic Operators: + - × / ^

Precedence of Operators

1. Brackets ()
2. Exponentiation ^
3. Unary Plus/Minus + -
4. Multiple / Divide * /
5. Addition / Subtraction + -

Declare / Assign Variables

```
Dim intX, intY, intZ As Integer
Dim doubleX, doubleY, doubleZ As Double
doubleX = 1.234
doubleY = doubleX + 5.6
Dim str As String = "Hello"
str = str & " World!"
```

Initialize by default to 0

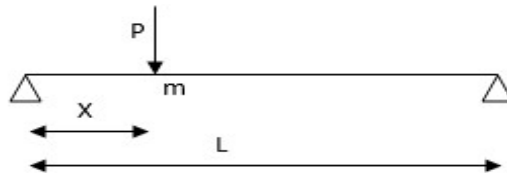
Double quotation
& concatenate strings

Subroutine

- Collect duplicated code in single subroutine
 - DRY: Don't Repeat Yourself
 - Never WET: Write Everything Twice

Example

- Calculate reactions and bending moment



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Subroutine Syntax

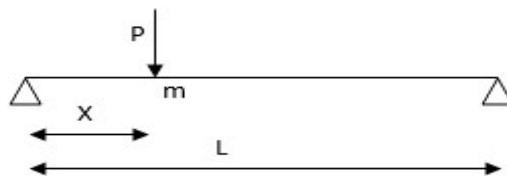
```

Module Program
  Sub SimpleBeamCalculate()
    Dim L, x, P As Double
    Dim RL, RR, m As Double
    L = 3.5 ' m
    x = 1.2 ' m
    P = 5 ' kN

    RR = P * x / L
    RL = P - RR
    m = RR * (L - x)

  End Sub
End Module

```



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Subroutine Homework

```

Module Program
  Sub SwapVariables()
    Dim Length, Width, Temp As Double
    Length = 4
    Width = 8
    ' Swap values
    Temp = Length ' 4
    Length = Width ' 8
    Width = Temp ' 4
    ' Length = 8
    ' Width = 4
  End Sub
End Module

```

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Study Material

- Contact:
w@el.sy
- Download material from:
 - <https://pro.el.sy/>
 - <http://damascusuniversity.edu.sy/civil/?lang=1&set=3&id=366>



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