

## CEE 379

## Excel Tutorial

This brief tutorial is intended to refresh your memory about basic spreadsheet capabilities, and to introduce you to the Microsoft Excel matrix operations. To start Excel, click on the start button. "Microsoft Excel" can be found under "Programs."

### BASIC OPERATIONS

➔ Enter the following letters and numbers into cells A1 to B5:

	A	B	C	D
1	E=	2		
2	1	2		
3	2	4		
4	3	6		
5	4	7		

- ➔ To enter a simple formula into cell C2, place cursor on cell C2 and
- type "= A2 + B2 + 2" (and Enter) or
  - type "=" (place cursor on A2) + (place cursor on B2) + 2" (and Enter)
- ➔ Select cell and copy it as follows:
- click "Edit/Copy", or
  - press "Ctrl-C", or
  - right click the mouse and select "Copy."

There should now be dashes moving around the cell, indicating that it has been copied.

- ➔ To paste the contents of C2 into C3-C5, highlight C3-C5 and:
- press "Enter", or
  - click "Edit/Paste", or
  - press "Ctrl-V", or
  - right click the mouse and select "Paste."

This is an example of a "relative formula." You told Excel to add the contents of the cell two columns over with the contents of the cell one column over plus 2.

➔ If you want to refer to a fixed cell address (e.g., properties such as E, I, or L), you don't have to retype the cell number each time. By typing a "\$" before the cell letter and number in your formula, Excel recognizes this as a fixed location when you copy and paste. This is referred to as an "absolute formula."

In cell D2 type "= (B2)^\$B\$1" or "=B2^B1<F4>", where <F4> means to press the F4 key. The F4 key simply puts the dollar signs in for you. Copy this cell and paste into cells D2 through D5. Are the numbers correct? Your spreadsheet should now look like this:

	A	B	C	D
1	E=	2		
2	1	2	5	4
3	2	4	8	16
4	3	6	11	36
5	4	7	13	49

➔ If you want to change your input, you don't have to change your formulas, so it is possible to automate calculations. Change the number in cell B1 from 2 to 3 and see what happens. Are the numbers in columns C and D still correct? You should have the following:

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>1</b>	E=	3		
<b>2</b>	1	2	5	8
<b>3</b>	2	4	8	64
<b>4</b>	3	6	11	216
<b>5</b>	4	7	13	343

### Matrix Operations

It can be tedious to solve a set of simultaneous equations by hand. For example, stiffness equations, in which nodal equilibrium is expressed as a function of nodal displacements (and rotations) and applied nodal forces, can be difficult to solve. In matrix form, these equations are expressed as.

$$[K_{11}] \{D_u\} = \{Q_k\}$$

Solving these equations by hand would be too time consuming for systems with more than a few members and nodes. You can solve simultaneous sets of equations by combining matrix inversion and multiplication.

$$\{D_u\} = [K_{inv}] \{Q_k\}$$

Let's go through an example of matrix inversion and multiplication.

➔ Highlight cells A7 to D10. Type "=minverse(A2:D5)", followed by Ctrl/Shift/Enter simultaneously. If you press "enter" only, you will not get the inverse. The inverted matrix should now appear in cells A7 to D10, as shown below:

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>6</b>				
<b>7</b>	-2.31	4.13	-4.31	2.00
<b>8</b>	-1.51	0.52	1.49	-1.00
<b>9</b>	1.25	-1.00	0.25	0.00
<b>10</b>	0.01	-0.02	0.01	0.00

Is this correct? Let's find out -- any scalar times its inverse is 1.0. Similarly, a matrix times its inverse gives the identity matrix.

➔ Highlight cells A12 to D15. Type "=MMULT(A2:D5, A7:D10)", followed by Ctrl/Shift/Enter. Do you have a 4x4 identity matrix?