Middle East Technical University **Spring 2010-2011**
Department of Economics
ECON 205

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LAB SET 04 – REVISED!

I. Excel function NORMDIST

Syntax

NORMDIST(x; mu; sigma; cumulative)

The NORMDIST parameters, *x*, *mu* and *sigma*, are numeric values, where the parameter, *cumulative*, is a logical TRUE or FALSE value. Sigma must be greater than 0.

In NORMDIST, when the last argument is set to TRUE (or 1, interpreted as TRUE), NORMDIST returns the *cumulative probability* that the observed value of a Normal random variable with mean *mu* and standard deviation *sigma* will be less than or equal to x. If cumulative is set to FALSE (or 0, interpreted as FALSE), NORMDIST returns the height of the bell-shaped *probability density curve*.

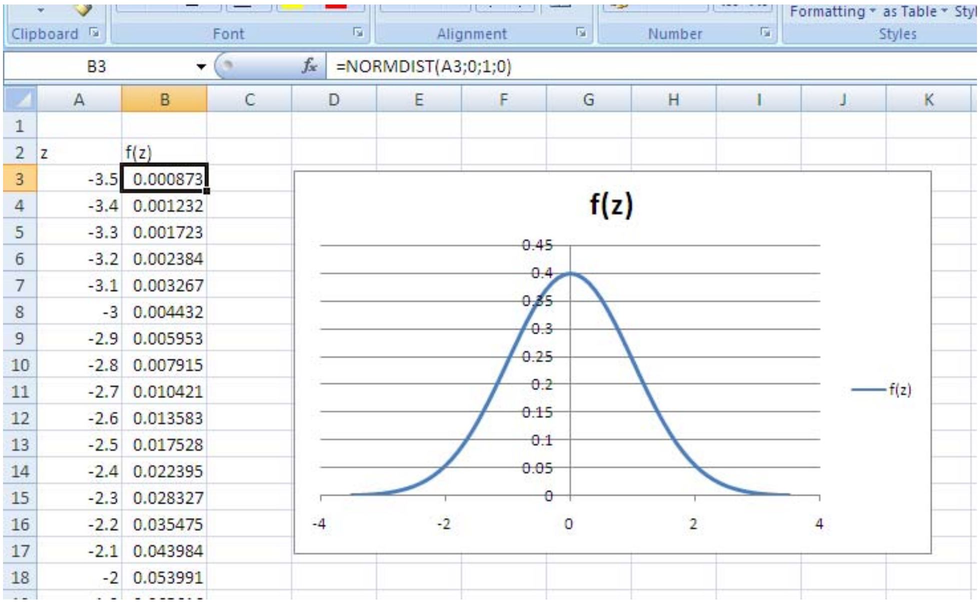
- *NORMDIST(x; mu; sigma; 1) = area to the left of x (cumulative prob. dist.)*
- *NORMDIST(x; mu; sigma; 0)= computes normal density function at x*
    - If *mu* = 0 and *sigma* = 1, then the NORMDIST function will produce *standard normal* distribution.
- **Important!** In Excel 2010, *NORMDIST* function has been replaced by:

  NORM.DIST(x; mu; sigma; cumulative) function.

II. Applications

Application 1 [Graphing the standard normal *density* function, *f(z)*]

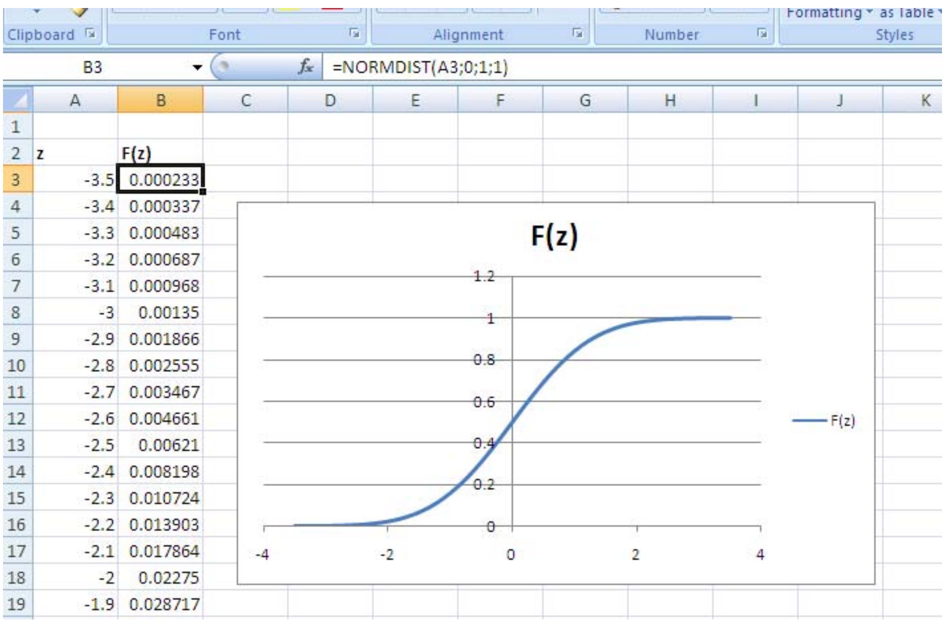
- Open a new workbook and name it as *density-z*
- Enter the labels z and f(z) in cells A2 and B2
- Enter –3.5 & -3.4 in cells A3 and A4, click and drag down until you create the sequence of digits from –3.5 to 3.5.
- Select B3 and enter =NORMDIST(A3; 0; 1; **0**)
- Select B3 and drag down to B73
- Select the data range of A2:B73
- Insert → Scatter → Scatter with Smooth Lines.



Application 2 [Graphing the standard normal *cumulative* distribution function, F(z)]

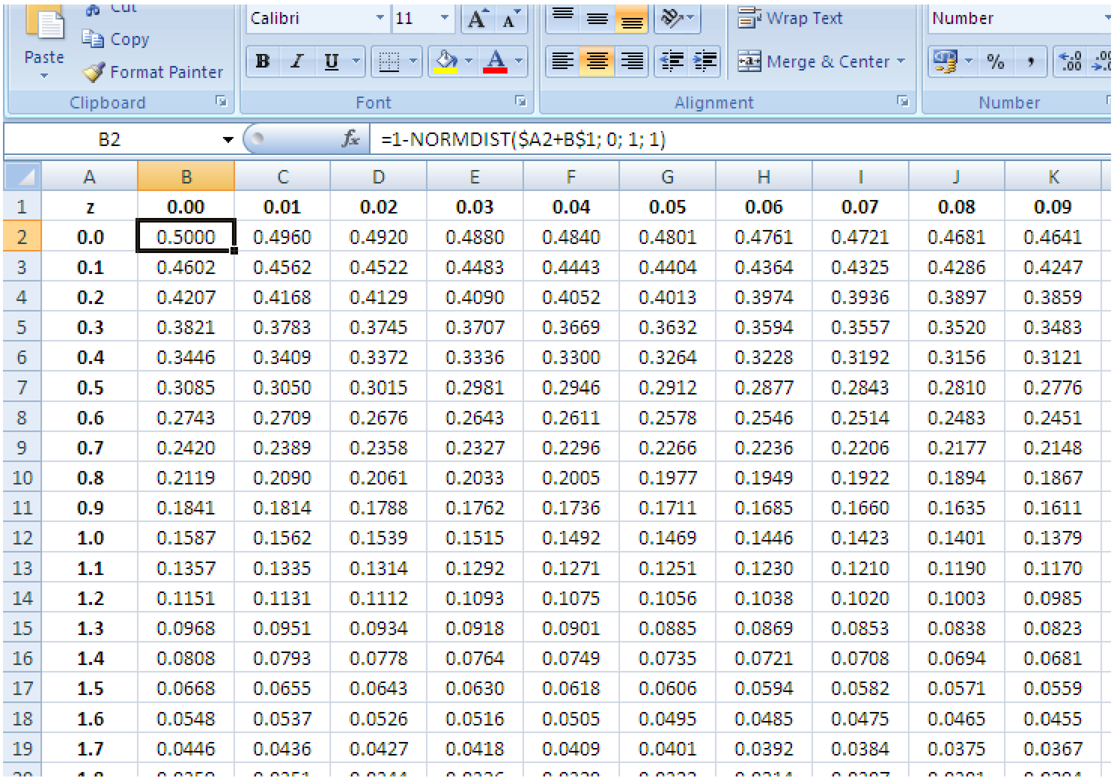
It is defined as the area under the standard normal to the left of z, that is F(z)=P(Z<=z)

- Open a new workbook and name it as *cumulative-z*
- Enter the labels z and f(z) in cells A2 and B2
- Enter –3.5 & -3.4 in cells A3 and A4, click and drag down until you create the sequence of digits from –3.5 to 3.5.
- Select B3 and enter =NORMDIST(A3; 0; 1; **1**)
- Select B3 and drag down to B73
- Select the data range of A2:B73
- Insert → Scatter → Scatter with Smooth Lines



Application 3 (Producing Normal Distribution Table)

- Open a new workbook and name it as *z_table*
- In Row 1 enter the label z and the values 0.00:0.09.
- In Column A enter the values 0.0:4.0 in steps of 0.1.
- In B2 enter the formula *=NORMDIST($A2+B$1; 0; 1; 1)* and copy across to K2 and down to Row 42 to obtain the cumulative Normal probabilities.
- To obtain the *tail probabilities* shown in Figure 1 below, replace this formula by *=1-NORMDIST($A2+B$1; 0; 1; 1)*



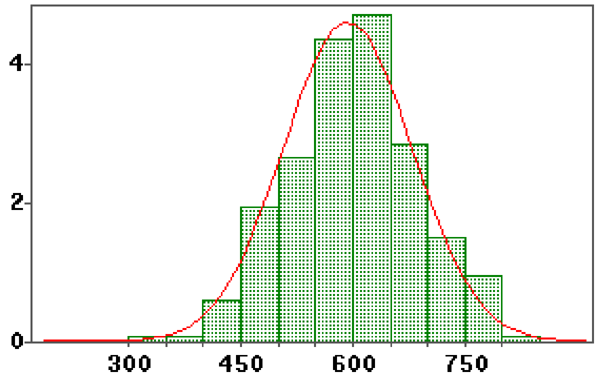
	A	B	C	D	E	F	G	H	I	J	K
1	z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2	0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
3	0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
4	0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
5	0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
6	0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
7	0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
8	0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
9	0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
10	0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
11	0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
12	1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
13	1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
14	1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
15	1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
16	1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
17	1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
18	1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
19	1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367

Figure 1 Standard normal probability in right-hand tail

Application 4

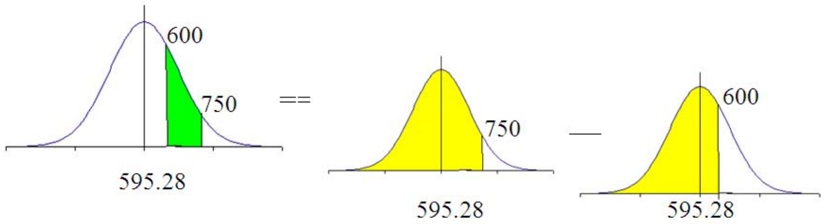
The distribution of the SATM scores for the CS students is approximately (see graph below) normal with mean 595.28 and standard deviation 86.40: N(595.28, 86.40).

- *What is the percentage of CS students that had SAT math scores between 600 and 750?*



We can use the normal approximation - It is the area under the normal density curve between 600 and 750 [We use the values of the Normal distribution function F(x)=P(X<=x)].

The percentage of students with SATM between 600 and 750 can be computed as



Therefore;

- Open a new workbook and name it as *z_prob*
- Select a cell, say A1
    - o Compute the area on the left of 600 as:

        =NORMDIST(600; 595.28; 86.40; 1)

- Select a cell, say A2
    - o Compute the area on the left of 750 as:

        =NORMDIST(750; 595.28; 86.40; 1)

- The area under the curve between 600 and 750 is:

    =NORMDIST(750; 595.28; 86.40; 1)-NORMDIST(600; 595.28; 86.40; 1)

    - o Thus, select a cell, say A3, and compute the area under the curve between 600 and 750 as:

        =A2-A1

- The answer is 0.4415. Hence, approximately 44% of CS students in the survey have SATM between 600 and 750.