Math 135 Formula Sheet

Linear Equations

$$Slope:\ m = \frac{y_2 - y_1}{x_2 - x_1}$$

slope intercept form: $y = mx + b$

$point\ slope\ form$: $y - y_1 = m(x - x_1)$

Augmented Matrix

$$\begin{matrix} Coefficient & Constraint \end{matrix}$$

$$\left[\begin{Bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{Bmatrix} \begin{matrix} k_1 \\ k_2 \end{matrix}\right]$$

Gauss-Jordan Elimination

One Solution

$$\left[\begin{array}{cc|c} 1 & 0 & m \\ 0 & 1 & n \end{array}\right]$$

Infinite Solutions

$$\left[\begin{array}{cc|c} 1 & m & n \\ 0 & 0 & 0 \end{array}\right]$$

No Solution

$$\left[\begin{array}{cc|c} 1 & m & n \\ 0 & 0 & p \end{array}\right]$$

Matrix Addition

Matrices must be same size

[m × n] + [m × n] = [m × n]

[m × n] + [m × p] = undefined

Matrix Multiplication

End of one matrix must match the beginning of the next matrix

[m × n] • [n × p] = [m × p]
Match

[m × n] • [p × q] = Undefined
No Match

Inverse Matrix

[M | I] ⇒ [I | M^{-1}]

$$\left[\begin{array}{cc|cc} a & b & 1 & 0 \\ c & d & 0 & 1 \end{array}\right] \Rightarrow \left[\begin{array}{cc|cc} 1 & 0 & e & f \\ 0 & 1 & g & h \end{array}\right]$$

Geometric Method for Solving Linear Programming Problem

- Find feasible region by graphing your constraints.
- Determine if a minimum or maximum exists.
- Find coordinates for the corners of the feasible region.
- Construct a corner point table.

- Determine the optimal solution.
- Interpret the solution(s).

<u>Simplex Tableau</u>

The number of constraint equals the number of slack variables.

$$\begin{array}{c} \\ s_1 \\ s_2 \\ P \end{array} \begin{array}{c} \begin{array}{ccccc} x_1 & x_2 & s_1 & s_2 & P \end{array} \\ \left[\begin{array}{ccccc|c} a_{11} & a_{12} & 1 & 0 & 0 & k_1 \\ a_{21} & a_{22} & 0 & 1 & 0 & k_2 \\ \hline -P_1 & -P_2 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

$$\begin{array}{c} \\ s_1 \\ s_2 \\ P \end{array} \begin{array}{c} \begin{array}{cccccc} x_1 & x_2 & x_3 & s_1 & s_2 & P \end{array} \\ \left[\begin{array}{cccccc|c} a_{11} & a_{12} & a_{13} & 1 & 0 & 0 & k_1 \\ a_{21} & a_{22} & a_{23} & 0 & 1 & 0 & k_2 \\ \hline -P_1 & -P_2 & -P_3 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

<u>Sets</u>

$$A \cup B = \{ x \mid x \in A \; or \; x \in B\}$$

$$A \cap B = \{ x \mid x \in A \; and \; x \in B\} \; A'$$

$$= \{ x \epsilon U \mid x \notin A\}$$

<u>Counting Methods</u>

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

Multiplication: If n operations (O_1, O_2, …, O_n) are performed, then there are $N_1 \cdot N_2 \cdot \ldots \cdot N_n$ outcomes.

<u>Combinations and Permutations</u>

$0 \le r \le n$

$${}_nC_r = \frac{n!}{r!(n-r)!} \qquad {}_nP_r = \frac{n!}{(n-r)!}$$

Arrangement Irrelevant — Order Specific

<u>Probabilities, Odds and Expected Values</u>

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \qquad P(A \mid B) = \frac{P(A \cap B)}{P(B)},\ P(B) \neq 0$$

$$P(A \cap B) = P(A) \cdot P(B|A) = P(B) \cdot P(A|B)$$

$$Independent\ Events: P(A \cap B) = P(A) \cdot P(B)$$

$$E(x) = x_1 P_1 + x_2 P_2 + \cdots + x_n P_n$$

$$Odds\ for\ an\ Event\ (E) = \frac{P(E)}{P(E')} \qquad Odds\ against\ an\ Event\ (E) = \frac{P(E')}{P(E)}$$

Markov Chains

$$P = \begin{array}{c c} & \begin{array}{cc} A & A' \end{array} \\ \begin{array}{c} A \\ A' \end{array} & \begin{bmatrix} AA & AA' \\ A'A & A'A' \end{bmatrix} \end{array}$$

$$Initial\ State: S_o = [A \quad A']$$

$$First\ State: S_1 = S_oP$$

$$Second\ State: S_2 = S_1P$$

$$\vdots$$

$$k - th\ State: S_k = S_{k-1}P$$

$$Powers\ of\ Transition\ Matrix: \ S_k = S_oP^k$$

A transition matrix P is regular if some power of P has *only positive* entries.

A Markov chain is a **regular Markov chain** if its transition matrix is regular.

Means and Measures of Dispersion

$$\begin{matrix} Mean \\ (Ungrouped) \end{matrix}: Mean = \frac{\sum_{i=1}^{n} x_i}{n} \qquad \begin{matrix} Standard\ Deviation \\ (Ungrouped) \end{matrix}: SD = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

$$\begin{matrix} Mean \\ (Grouped) \end{matrix}: \ Mean = \frac{\sum_{i=1}^{n} x_i f_i}{n} \qquad \begin{matrix} Standard\ Deviation \\ (Grouped) \end{matrix}: SD = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2 f_i}{n-1}}$$

$$Mean = \ \bar{x}\ (sample) or\ \mu\ (population) \qquad SD = s\ (sample)\ or\ \sigma\ (population)$$

Binomial Distribution

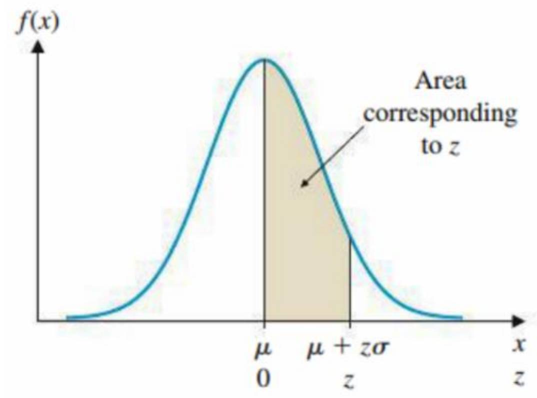
$$\mu = np \qquad \sigma = \sqrt{npq}$$

z-Score

$$z = \frac{x - \mu}{\sigma}$$

Area under the Standard Normal Curve

The table entries represent the area under the Standard Normal Curve from 0 to z for $z \geq 0$



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000