

Chp 3 The Normal Distributions

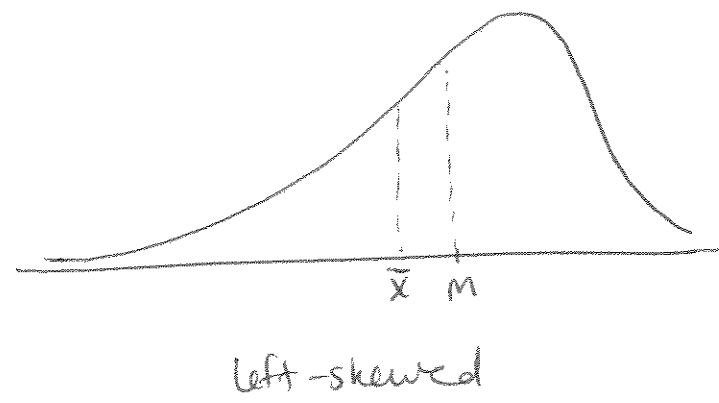
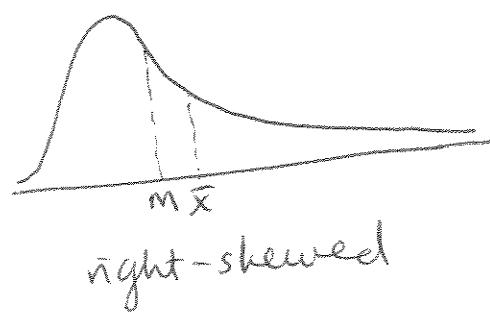
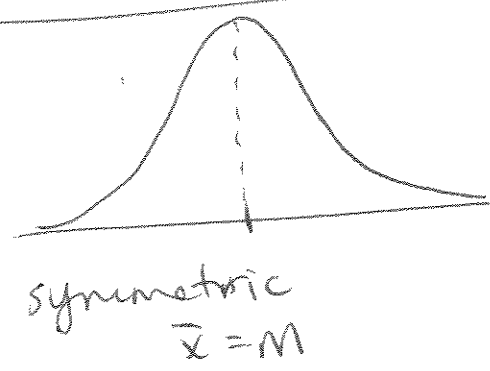
★ Typically, the histogram for a large # of observations can be described by a smooth curve!

Vocab • density curve: a smooth curve that describes the overall pattern of a distribution; the area under the curve, for a certain interval, tells percent of all observations that fall in that interval

- Two conditions for density curve
- ① curve is always above x-axis
 - ② area under curve = 1

median: x-value that divides curve such that there is equal area on either side

mean: x-value that is "balance point" (like a teeter-totter)



Notation

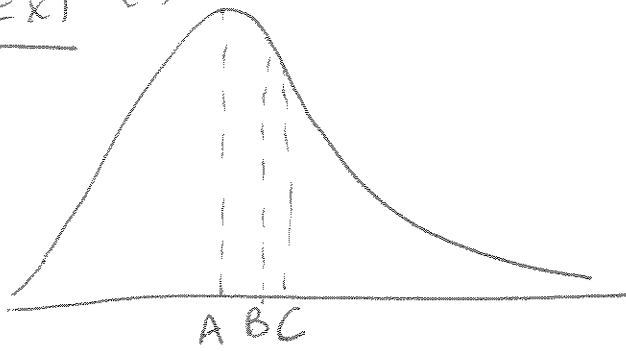
mean = μ

standard deviation = σ

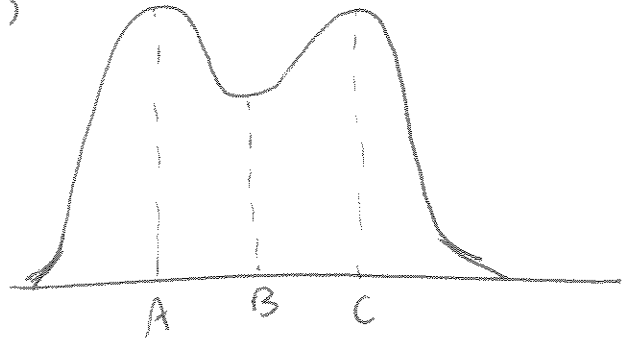
Chp 3 (cont)

Where are mean, median, mode?

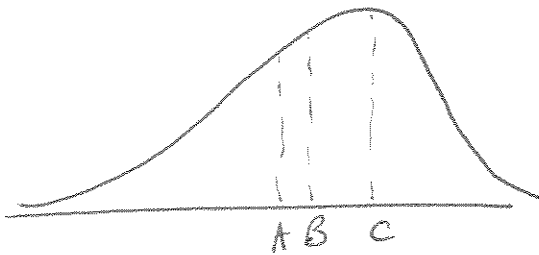
Ex 1 (a)



(b)



(c)

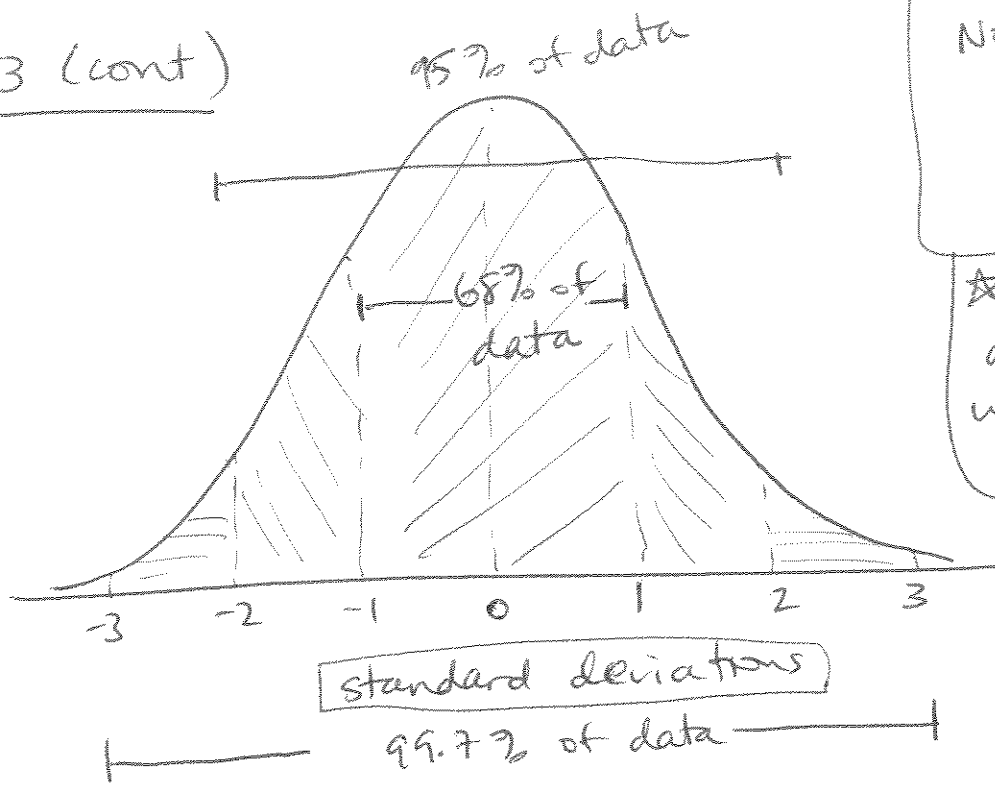


Normal Distributions / Density Curves

- they all have same shape: symmetric, single-peaked, bell-shaped.
- completely described by μ & σ
- μ = median also; changing μ and not σ just moves curve over
- σ gives spread of data (large σ -values means curve is more spread out)
(σ measures horizontal distance from μ to change-of-curvature)

- ~68% of observations are w/m 1σ away from μ .
- ~95% " " " " 2σ " "
- ~99.7% " " " " 3σ " "

Chp 3 (cont)



Normal Distribution
Notation

$$N(\mu, \sigma)$$

* Note: μ & σ
are measured
w/ same units

Ex 2 Times for the mile run of a large group of male college students are approximately $N(7.11 \text{ mins}, 0.74 \text{ min})$.

(a) What range of times cover 99.7% of data?

(b) What percent of these men run a mile in less than 6.37 mins?

(c) What percent of these men run a mile in more than 8.59 mins?

Chp 3 (cont)

z-score (aka standardized x-value)

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

why?
what does this tell us?

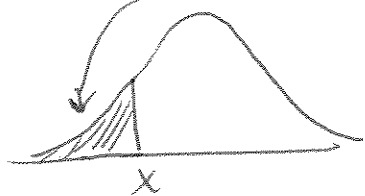
Standard Normal is $N(0,1)$.

If x has $N(\mu, \sigma)$ distribution, then $z = \frac{x - \mu}{\sigma}$ is $N(0,1)$.

cumulative proportion: proportion of observations in distribution that are less than or equal to x

(i.e. area under curve to left of x)

(Note: remember total area under curve is 1.)



Using Standard Normal Table (Table A in book)

- ① state problem w/ $x \sim N(\mu, \sigma)$ + draw graph/picture if that's helpful
- ② convert x to z-score
- ③ use Table A to find area you want

Chp 3 (cont)

Ex 3 Use Table A to find proportion of observations from $N(0,1)$ that satisfy following.

(a) $z < 2.85$

(b) $z > 2.85$

(c) $-1.66 < z < 2.85$

(d) $0.5 < z < 0.75$

Chp 3 (cont)

Ex 4 The summer monsoon rains in India follow $N(852\text{mm}, 82\text{mm})$.

(a) In what percent of years will India have 697mm or less of monsoon rain?

(b) In what % of years is rainfall between 683mm and 1022mm?

Chp 3 (cont)

Ex 5 Use Table A to find z for $N(0,1)$ given:

(a) 20% of observations falls below it.

(b) 40% of observations are above it.

Ex 6 For $N(0.8, 0.078)$, what are

(a) median

(b) first quartile

(c) third quartile?

TABLE 1

Table entry for z is the area under the standard Normal curve to the left of z .

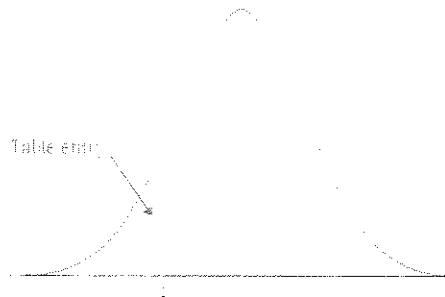


TABLE A Standard Normal cumulative probabilities

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

