

Math 140 Midterm 1

(Dated: February 20 2013)

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Write clearly and box all your answers. Do not work out of memory, rather think before starting.
Use the back for more space. Show all steps you are performing.

104

1) This table shows the weights of some US pennies. Find mean weight and standard deviation.

Weight	Frequency
2.99	1
3.01	4
3.03	4
3.05	4
3.07	7
3.09	17
3.11	24
3.13	17
3.15	13
3.17	6
3.19	2
3.21	1

$$\bar{x} = 3.11 \quad (6.5)$$

$$SD = 0.04 \quad (6.5)$$

2) The standard deviation of these values 16 23 34 56 78 92 93 is about 32.

i) What is the range of this distribution? $93 - 16 = 77$

ii) Without performing any computation evaluate the standard deviation of these values (compare with the values given above) 20 27 38 60 82 96 97. Explain.

Same as above,

data is only

shifted, and "recentering" does not change SD.

Here the second set of data is recentered by 4

- 3) Suppose a constant c is added to each value in a set of data x_1, x_2, x_3, x_4, x_5 . Prove that the mean increases by c by comparing the formula for the mean of the original data to the formula for the mean of the recentered data.

13

$$\bar{x} = \frac{x_1 + x_2 + x_3 + x_4 + x_5}{5}$$

$$\bar{x}_c = \frac{x_1 + c + x_2 + c + x_3 + c + x_4 + c + x_5 + c}{5}$$

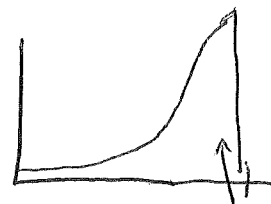
$$= \frac{x_1 + x_2 + x_3 + x_4 + x_5}{5} + \frac{5c}{5}$$

$$\approx \bar{x} + c$$

- 4) Describe each distribution as clustered, skewed right, skewed left, approximately normal or roughly uniform. Make a small sketch of these distributions.

- 3.25 i) ages of all people who died in the US last year
 3.25 ii) ages of all people who got their first driver's licence in California last year
 3.25 iii) SAT scores for all California students taking the test
 3.25 iv) selling prices of all cars sold by GM last year

i) SKEWED LEFT



most deaths here ≈ 85 y.

ii) " RIGHT

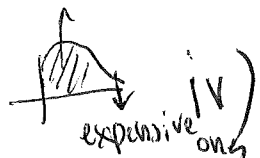


16/18

most people get D.L. at 16

most cars

iii) NORMAL



expensive ones

iv) SKEWED RIGHT
a few will cost a lot

most cars will cost a "low" price $\approx 20K$

5) Refer to the following data for the two classes taught by a history professor:

early
later

Class A: 99, 95, 69, 91, 79, 67, 64, 54, 68, 47, 53, 86, 100, 95, 45, 41, 59, 66

Class B: 84, 68, 94, 77, 88, 75, 88, 91, 83, 61, 97, 75, 37, 82, 62, 49, 43, 93

4.33

i) Make a table that divides the course data into 'pass' (60 or more) and 'fail' (less than 60).

4.33

ii) What proportion of the students in the earlier class passed? What proportion of the students who passed were in the earlier class? What proportion of students passed overall?

(1.443)

4.33

iii) Make a back-to-back stemplot for the two classes and comment on any relevant features.

see back

$$x = \bar{x} + z \cdot SD = 505 + 1.645 \cdot 111 = 687.6$$

$$505 - 1.645 \cdot 111 = 322.4$$

} between the two

$$\bar{x} = 505 \quad SD = 111$$

6) SAT scores are scaled to be approximately normal with Mean 505 and Standard Deviation 111.

i) Find the probability that a randomly selected student has an SAT score

3.25

a) over 700 → 3.92% — 4.01% Table.

3.25

b) below 450 → 30.85% — 31.21% Table.

3.25

c) between 400 and 600 → 63.4% — 62.87% Table.

3.25

ii) For the normal distribution, about 90% of data falls in between the values of -1.645 and

1.645. Given this fact, what SAT scores fall in the middle 90% of the distribution? z score

$$z = \frac{x - \bar{x}}{SD} = \frac{700 - 505}{111} = 1.757 \rightarrow 0.9608 \rightarrow 3.92\%$$

$$z = \frac{x - \bar{x}}{SD} = \frac{450 - 505}{111} = -0.495 \rightarrow 0.3085 \rightarrow 30.85\%$$

$$z = \frac{x - \bar{x}}{SD} \rightarrow \frac{400 - 505}{111} = -0.946 \rightarrow 0.1711 \rightarrow 80.51\%$$

$$\frac{600 - 505}{111} = 0.856 \rightarrow 0.8051 \rightarrow 17.11\%$$

$$80.51 - 17.11$$

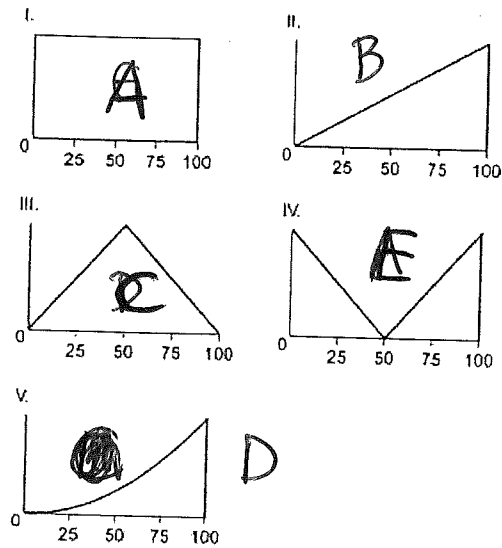


FIG. 1: Match these distributions with the sets in problem 8.

7) Match each plot in Fig. 1 with its median, and quartiles listed below. Discuss your reasoning.

- | | | | |
|-----|---------------|--------------|--------------|
| 2.4 | a) 25, 50, 75 | 4 | 1 |
| 2.4 | b) 50, 71, 87 | 2 | 2 |
| 2.4 | c) 35, 50, 65 | 5 | 3 |
| 2.2 | d) 63, 79, 91 | 3 | 5 |
| 2.4 | e) 15, 50, 85 | 1 | 4 |

8) Convert each of these values from x to standard values z and viceversa, as indicated.

2.166	$x = 12, \bar{x} = 10, SD = 2$	$z = ?$	1
	$x = 12, \bar{x} = 10, SD = 1$	$z = ?$	2
4	$x = 7, \bar{x} = 10, SD = 3$	$z = ?$	-1
	$z = 2, \bar{x} = 20, SD = 5$	$x = ?$	30
	$z = -1, \bar{x} = 20, SD = 5$	$x = ?$	15
	$z = 2.5, \bar{x} = -10, SD = 0.2$	$x = ?$	-9.5

$$z = \frac{x - \bar{x}}{SD}$$

$$x = \bar{x} + z \cdot SD$$

$$z = \frac{12 - 10}{2} = 1$$

$$z = \frac{12 - 10}{1} = 2$$

$$z = \frac{7 - 10}{3} = -1$$

$$x = 20 + 2 \cdot 5 = 30$$

$$x = 20 + (-1) \cdot 5 = 15$$

$$x = -10 + 2.5 \cdot 0.2 = -9.5$$

Appendix: Statistical Tables

Table entry for z is the probability lying below z .

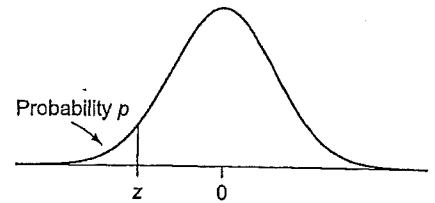


TABLE A Standard Normal Probabilities

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.8	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-3.7	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-3.6	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-3.5	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002
-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

		Problem 5		
		Fail	Pass	Total
A	Early	6	12	18
B	Late	3	15	18
Total		9	27	36

A/early: 12 out of 18 passed in A
 $\frac{12}{18} = 67\%$ (or 66.66%)

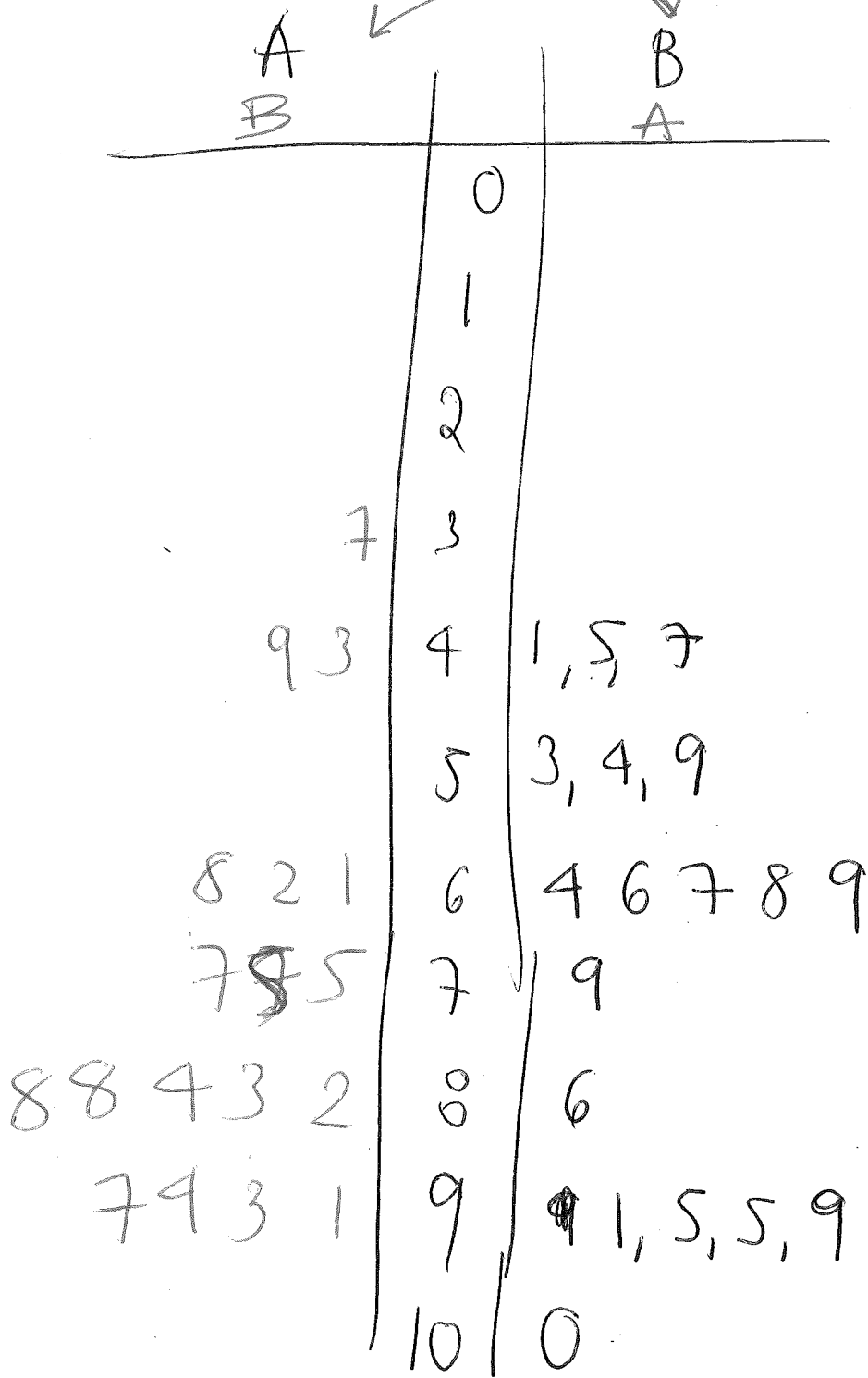
12 out of 27 who passed were in A

$$\frac{12}{27} \approx 44\%$$

27 out of 36 passed overall

$$\frac{27}{36} = 75\%$$

STEM PLOT
Switch



they seem fairly consistent / uniform
 but it seems that students in B
 did slightly worse.