PG 1

Chapter 2 AP Statistics Practice Test

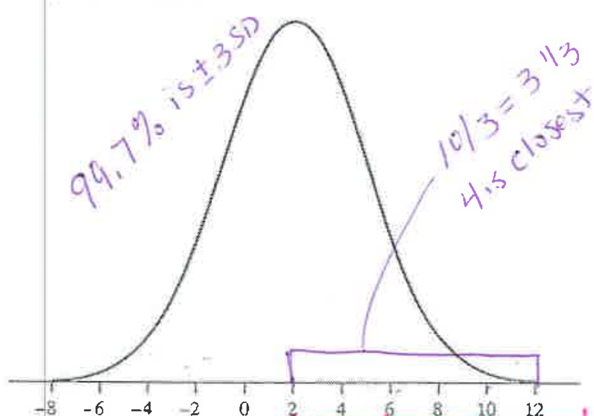
Section I: Multiple Choice *Select the best answer for each question.*

T2.1. Many professional schools require applicants to take a standardized test. Suppose that 1000 students take such a test. Several weeks after the test, Pete receives his score report: he got a 63, which placed him at the 73rd percentile. This means that

73

(a) Pete's score was below the median.
(b) Pete did worse than about 63% of the test takers.
(c) Pete did worse than about 73% of the test takers.
(d) Pete did better than about 63% of the test takers.
(e) Pete did better than about 73% of the test takers.

T2.2. For the Normal distribution shown, the standard deviation is closest to



99.7% is ±3SD

10/3 = 3 1/3
4 is closest

1σ 2σ 3σ

(a) 0 (b) 1 (c) 2 (d) 4 (e) 5

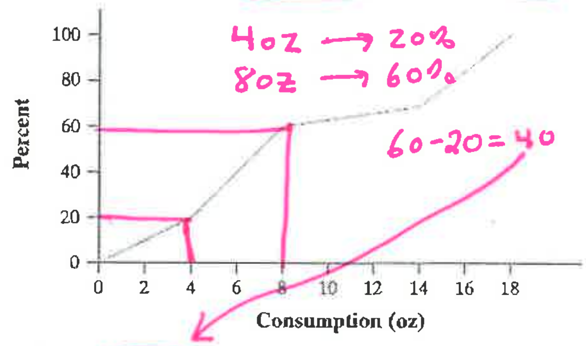
T2.3. Rainwater was collected in water collectors at 30 different sites near an industrial complex, and the amount of acidity (pH level) was measured. The mean and standard deviation of the values are 4.60 and 1.10, respectively. When the pH meter was recalibrated back at the laboratory, it was found to be in error. The error can be corrected by adding 0.1 pH units to all of the values and then multiplying the result by 1.2. The mean and standard deviation of the corrected pH measurements are

(a) 5.64, 1.44 (c) 5.40, 1.44 (e) 5.64, 1.20
(b) 5.64, 1.32 (d) 5.40, 1.32

N(4.60, 1.10) — 1ST ADD 0.1
2ND MULT BY 1.2

MEAN = (4.6 + 0.1) × 1.2 = 5.64
SD = (1.10) × 1.2 = 1.32

T2.4. The figure shows a cumulative relative frequency graph of the number of ounces of alcohol consumed per week in a sample of 150 adults. About what percent of these adults consume between 4 and 8 ounces per week?

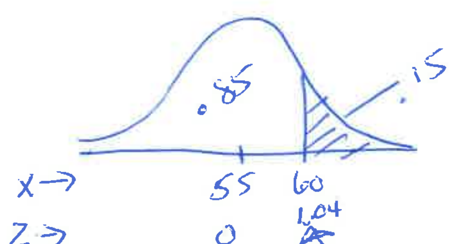


4oz → 20%
8oz → 60%
60 − 20 = 40

(a) 20% (b) 40% (c) 50% (d) 60% (e) 80%

T2.5. The average yearly snowfall in Chillyville is Normally distributed with a mean of 55 inches. If the snowfall in Chillyville exceeds 60 inches in 15% of the years, what is the standard deviation?

(a) 4.83 inches
(b) 5.18 inches
(c) 6.04 inches
(d) 8.93 inches
(e) The standard deviation cannot be computed from the given information.



$Z = \text{invNorm}(.85, 0, 1) = 1.035$

$Z = 1.04 = \frac{60-55}{\sigma}$

$\frac{1.04\sigma}{1.04} = \frac{5}{1.04}$

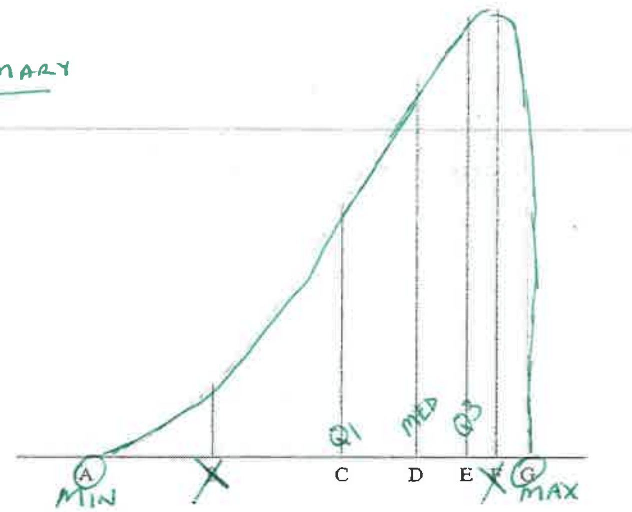
$\boxed{\sigma = 4.81}$

$\sigma = \frac{5}{1.035} = 4.83$ ✓

PG2

T2.6. The figure shown is the density curve of a distribution. Five of the seven points marked on the density curve make up the five-number summary for this distribution. Which two points are *not* part of the five-number summary?

5 number Summary
min
Q1
MEDIAN
Q3
MAX



(a) B and E (c) C and E (e) A and G
(b) C and F (d) B and F

T2.7. If the heights of American men follow a Normal distribution, and 99.7% have heights between 5′0″ and 7′0″, what is your estimate of the standard deviation of the height of American men?

99.7% is +/- 3 SD
2 ft = 24 in / 6 = 4″

(a) 1″ (b) 3″ (c) 4″ (d) 6″ (e) 12″

T2.8. Which of the following is *not* correct about a standard Normal distribution?

(a) The proportion of scores that satisfy $0 < z < 1.5$ is 0.4332. Normalcdf (0, 1.5, 0, 1) = .4332
(b) The proportion of scores that satisfy $z < -1.0$ is 0.1587. normalcdf (−E99, −1, 0, 1)
(c) The proportion of scores that satisfy $z > 2.0$ is 0.0228. normalcdf (2, E99, 0, 1)
(d) The proportion of scores that satisfy $z < 1.5$ is 0.9332. normalcdf (−E99, 1.5, 0, 1)
(e) The proportion of scores that satisfy $z > -3.0$ is 0.9938. normalcdf (−3, E99, 0, 1) = .9987

Questions T2.9 and T2.10 refer to the following setting. Until the scale was changed in 1995, SAT scores were based on a scale set many years ago. For Math scores, the mean under the old scale in the 1990s was 470 and the standard deviation was 110. In 2009, the mean was 515 and the standard deviation was 116.

OLD SAT (1990) N (470, 110)
2009 N (515, 116)

T2.9. What is the standardized score (*z*-score) for a student who scored 500 on the old SAT scale?

$Z = \frac{500 - 470}{110} = .27$

(a) −30 (b) −0.27 (c) −0.13 (d) 0.13 (e) 0.27

T2.10. Jane took the SAT in 1994 and scored 500. Her sister Colleen took the SAT in 2009 and scored 530. Who did better on the exam, and how can you tell?

Jane (OLD) $z = \frac{500 - 470}{110}$
$z = .27$

(a) Colleen—she scored 30 points higher than Jane.
(b) Colleen—her standardized score is higher than Jane's.
(c) Jane—her standardized score is higher than Colleen's.
(d) Jane—the standard deviation was bigger in 2009.
(e) The two sisters did equally well—their *z*-scores are the same.

Colleen (NEW)
$Z = \frac{530 - 515}{116}$
$Z = .13$

Section II: Free Response *Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.*

PG 3

T2.11 As part of the President's Challenge, students can attempt to earn the Presidential Physical Fitness Award or the National Physical Fitness Award by meeting qualifying standards in five events: curl-ups, shuttle run, sit and reach, one-mile run, and pull-ups. The qualifying standards are based on the 1985 School Population Fitness Survey. For the Presidential award, the standard for each event is the 85th percentile of the results for a specific age group and gender among students who participated in the 1985 survey. For the National award, the standard is the 50th percentile. To win either award, a student must meet the qualifying standard for all five events.

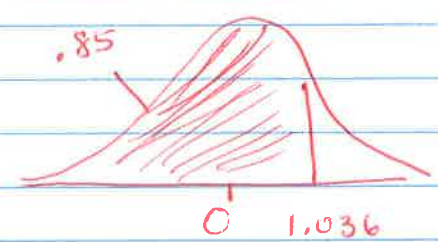
Jane, who is 9 years old, did 40 curl-ups in one minute. Matt, who is 12 years old, also did 40 curl-ups in one minute. The qualifying standard for the Presidential award is 39 curl-ups for Jane and 50 curl-ups for Matt. For the National award, the standards are 30 and 40, respectively.

(a) Compare Jane's and Matt's performances using percentiles. Explain in language simple enough for someone who knows little statistics to understand.

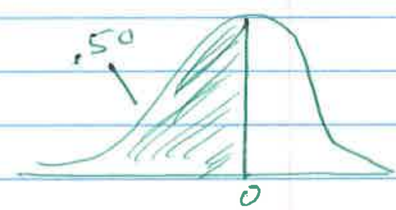
(b) Who has the higher standardized value (z-score), Jane or Matt? Justify your answer.

(A) SEE GRAPHS BELOW. JANE PERFORMED BETTER THAN MATT. JANE DID 40 CURLS WHICH WAS BETTER 85% of GIRLS HER AGE (39) ON PRESIDENTIAL AND DID BETTER THAN 50% OF GIRLS HER AGE (30) ON NATIONAL AWARD, SHE WOULD QUALIFY FOR BOTH AWARDS. MATT ONLY QUALIFIED FOR NATIONAL AWARD

President AWARD



NATIONAL AWARD



Curl ups

Jane - 40
Matt - 40

Jane's standard 39 Jane's 40 met standard
Matt's standard 50 Matt's 40 did NOT meet standard

Jane's standard 30 Jane's 40 Beat standard
Matt's standard 40 Matt's 40 met standard

(B) SINCE JANE'S POSITION IN HER DISTRIBUTION BASED ON GIRLS HER AGE WAS SO MUCH HIGHER THAN MATT'S GROUP, JANE'S ZSCORE WOULD BE HIGHER.

T2.12. The army reports that the distribution of head circumference among male soldiers is approximately Normal with mean 22.8 inches and standard deviation 1.1 inches.

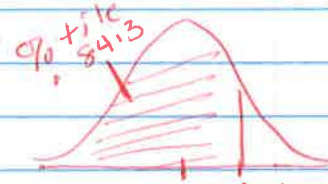
(a) A male soldier whose head circumference is 23.9 inches would be at what percentile? Show your method clearly.

(b) The army's helmet supplier regularly stocks helmets that fit male soldiers with head circumferences between 20 and 26 inches. Anyone with a head circumference outside that interval requires a customized helmet order. What percent of male soldiers require custom helmets? Show your work, including a well-labeled sketch of a Normal curve.

(c) Find the interquartile range for the distribution of head circumference among male soldiers. Show your method clearly.

$N(22.8, 1.1)$

(a)



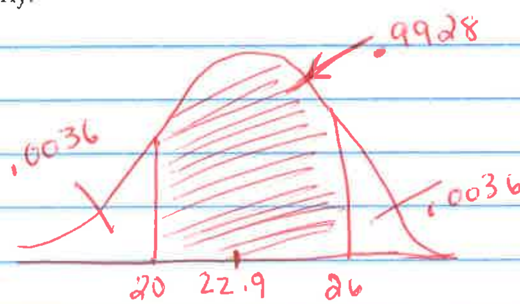
$$z = \frac{23.9 - 22.8}{1.1} = 1.0$$

area $= Z < 1.0 = .8413$

normalcdf(-E99, 1, 0, 1)

The proportion of observations lower is .8413. This means the soldier's head circumference is in the 84^{Th} percentile

(b)



$$z = \frac{20 - 22.8}{1.1} = -2.55$$

$$z = \frac{26 - 22.8}{1.1} = 2.91$$

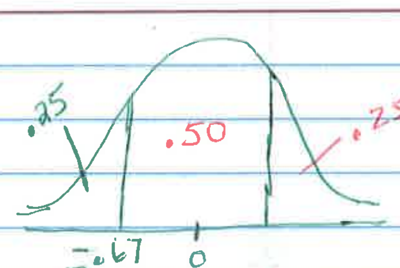
area : $-2.55 < Z < 2.91 = .9928$

normalcdf(-2.55, 2.91, 0, 1)

$1 - .9928 = .0072$

Approximately 0.7% of the soldiers REQUIRE A COSTUM HELMET.

(c)



invNorm(.25, 0, 1)   invNorm(.75, 0, 1)

Q1: $z = -.67 = \frac{X - 22.8}{1.1}$

$X = 22.063$

Q3: $z = .67 = \frac{X - 22.8}{1.1}$

$X = 23.537$

Q1 is 22.063 in and Q3 is 23.537 in and the IQR was 1.474 in (IQR = Q3(23.537) − Q1(22.063))

T2.13 A study recorded the amount of oil recovered from the 64 wells in an oil field. Here are descriptive statistics for that set of data from Minitab.

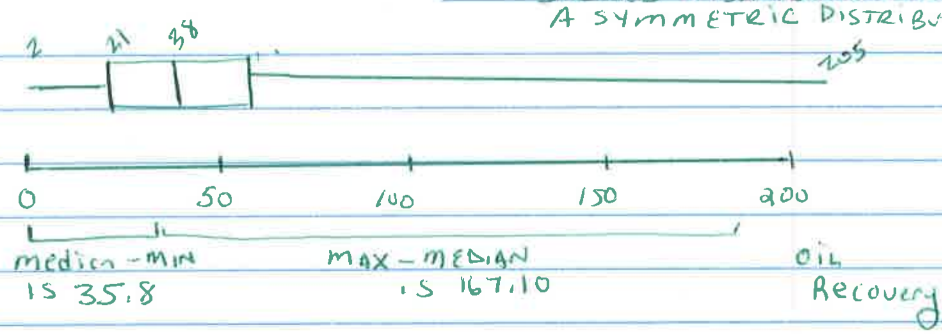
Descriptive Statistics: Oilprod

Variable	N	Mean	Median	StDev	Min	Max	Q_1	Q_3
Oilprod	64	48.25	37.80	40.24	2.00	204.90	21.40	60.75

Does the amount of oil recovered from all wells in this field seem to follow a Normal distribution? Give appropriate statistical evidence to support your answer.

① The mean (48.25) and median (37.80) have a large difference indiccting the distribution is NOT symmetric.

② A BOX PLOT SHOWS A SKEWED DISTRIBUTION NOT A SYMMETRIC DISTRIBUTION



IN CONCLUSION, THE DATA DOES NOT APPEAR TO FOLLOW A NORMAL DISTRIBUTION. THE DISTRIBUTION IS NOT SYMMETERIC SINCE THE MEAN AND MEDIAN ARE VERY DIFFERENT. A BOX PLOT DISPLAYS A SKEWED RICHT DISTRIBUTION.