STATISTICS
SECTION II
Part A
Questions 1-5

Spend about 65 minutes on this part of the exam.

Percent of Section II grade—75

Directions: 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 of your results and explanation.

1. A consumer advocate conducted a test of two popular gasoline additives, A and B. There are claims that the use of either of these additives will increase gasoline mileage in cars. A random sample of 30 cars was selected. Each car was filled with gasoline and the cars were run under the same driving conditions until the gas tanks were empty. The distance traveled was recorded for each car.

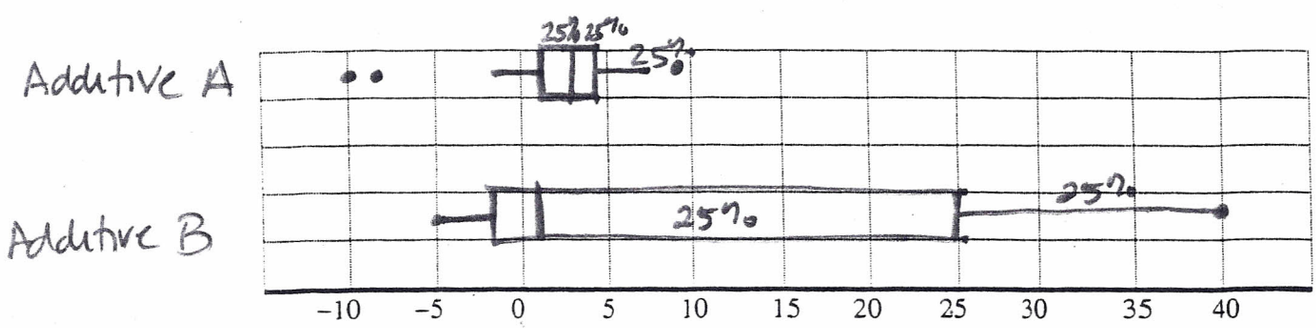
   Additive A was randomly assigned to 15 of the cars and additive B was randomly assigned to the other 15 cars. The gas tank of each car was filled with gasoline and the assigned additive. The cars were again run under the same driving conditions until the tanks were empty. The distance traveled was recorded and the difference in the distance with the additive minus the distance without the additive for each car was calculated.

   add - w/out

   The following table summarizes the calculated differences. Note that negative values indicate less distance was traveled with the additive than without the additive.

Additive	Values Below Q_1	Q_1	Median	Q_3	Values Above Q_3
A	−10, −8, −2	1	3	4	5, 7, 9
B	−5, −3, −3	−2	1	25	35, 37, 40

(a) On the grid below, display parallel boxplots (showing outliers, if any) of the differences of the two additives.



(b) Two ways that the effectiveness of a gasoline additive can be evaluated are by looking at either

- the proportion of cars that have increased gas mileage when the additive is used in those cars

  or

- the mean increase in gas mileage when the additive is used in those cars.

i. Which additive, A or B, would you recommend if the goal is to increase gas mileage in the highest proportion of cars? Explain your choice.

ii. Which additive, A or B, would you recommend if the goal is to have the highest mean increase in gas mileage? Explain your choice.

(A) IQR = 4 − 1 = 3

1.5 (3) = 4.5

Q_3 + 4.5

4 + 4.5

8.5

Q_1 − 4.5

1 − 4.5

−3.5

(B) IQR = 25 + 2 = 27

1.5(27) = 40.5

Q_3 + 40.5 Q_1 − 40.5

Part bi)

- ans → - Additive A is better at increasing the mileage in the greatest # of cars.
- why → - The mileage ↑ for at least 75% of cars w/ additive A but decreased for more than 25% of the cars ~~see~~ with additive B.
- address both

bii)

- answer - Additive B seems to have a higher mean gain than A.
- why - Boxplot B shows a skew to the right (the larger values)
  Thus the mean will be much greater than the median (1).

  In boxplot A there is less variability and it's skewed to the left.
  Thus the mean will be less than the median (3).

~~So Additive B~~