# MOCK FRQ #7

A random sample of 29 employees of a large company have their systolic blood pressure checked. Summary statistics are provided in the table below. Assume that the systolic blood pressure of all U.S. adults follows a normal distribution with a mean of 122 mm Hg and a standard deviation of 20 mm Hg.

| n | mean | SD | min | $Q_1$ | med | $Q_3$ | max |
|---|---|---|---|---|---|---|---|
| 29 | 139.862 | 17.505 | 110 | 124.5 | 140 | 156 | 175 |

(a) Approximately what percent of all U.S. adults have a systolic blood pressure greater than 142 mm Hg?

$\mu = 122$, $\sigma = 20$
$P(X > 142) = normalcdf(LB = 142, UB = \infty, \mu = 122, \sigma = 20) = 0.1587$

OR

$Z = \frac{142-122}{20} = 1$
$P(Z > 1) \approx 0.16$ by the 68-95-99.7 rule

(b) Describe the distribution of systolic blood pressure for the 29 employees of this company that were sampled.

Shape – The distribution is roughly symmetric because the mean and median are essentially equal

Center – The mean and median of the distribution is around 140 mm Hg

Spread – The standard deviation is 17.5 mm Hg. (or the IQR is 31.5 mm Hg)

Outliers: 1.5(31.5) = 47.25
156 + 47.25 = 203.25; there are no employees with a systolic blood pressure greater than 203.25
140 – 47.25 = 92.75; there are no employees with a systolic blood pressure less than 92.75
So, there are no outliers.

(c) The company CEO wants to know if the mean systolic blood pressure of employees at her company is higher than the national average. State the hypotheses for testing this concern.

$\mu$ = the true mean systolic blood pressure for all employees at the company.

$H_0$: $\mu = 122$

$H_a$: $\mu > 122$

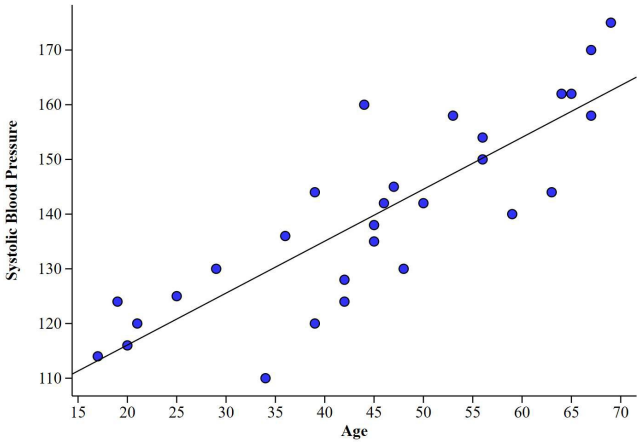
(d) The conditions for the hypothesis test in part (c) were satisfied. The hypothesis test resulted in a t-score of 5.495 and a p-value of $3.591 \times 10^{-6}$. Interpret the p-value in the context of this hypothesis test. What would this p-value lead you to conclude?

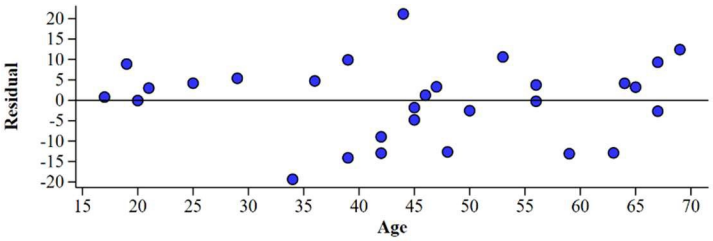
Assuming the mean systolic blood pressure at this company is 122 mm Hg, there is a probability of only 0.000003591 of obtaining a sample of 29 employees with a mean systolic blood pressure of 139.862 mm Hg or more. This is essentially impossible and therefore, we have convincing evidence to reject the null hypothesis and claim that the mean systolic blood pressure of all employees of this company is greater than 122 mm Hg.

(e) Explain in context what it would mean to make a type II error for the hypothesis test in parts (c) and (d).

A type II error in this problem would be deciding not to reject the null hypothesis and claiming that the mean systolic blood pressure of employees in this company was not over 122 mm Hg, when in fact it was actually greater than 122 mm Hg.

In addition to recording the systolic blood pressure of the 29 employees at the company, their ages were also recorded. A linear regression model was fit to these data. Graphical and numerical summaries of this analysis are given below. Use this information to answer the questions that follow.




| Predictor | Coef | SE Coef | T | P |
|---|---|---|---|---|
| Constant | 97.0771 | 5.5272 | 17.562 | .000 |
| Age | 0.9493 | 0.1161 | 8.174 | .000 |
| S = 9.563 | | R-Sq = 0.712 | | |

(f) Interpret the slope of the regression line in this context.

The slope of the regression line is 0.9493. This means that for each additional year of age, the model predicts an increase in systolic blood pressure of 0.9493 mm Hg.

(g) Comment on the strength, direction, and form of the relationship between age and systolic blood pressure. Explain.

$r^2 = .712 \rightarrow r = .844$

There is a strong, positive, linear relationship between age and systolic blood pressure. The relationship is strong because $r > 0.8$. It is positive because the slope of the line is positive. A linear model fits the data well based on the randomness of the residual plot.