Math-146 - Exam #1 - Practice (F21)

General Information

- You will have 50 minutes to complete Exam #1
- You are not allowed to use anything on the exam besides a pencil/pen and paper
- The exam with contain 3 questions that are each divided into a few parts

Exam topics

1) **Data basics** - cases, variables, variable types
2) **Univariate graphs and summaries** - frequencies/proportions, barcharts, dotplots/histograms, shape, center (mean/median), spread (standard deviation/range/IQR), and boxplots/five number summaries
3) **Bivariate graphs and summaries** - contingency tables, conditional proportions, stacked barcharts, side-by-side graphs, comparative summaries, scatterplots, correlation, regression, ecological fallacy, and extrapolation

Types of content to expect

- 1 questions that resembling those from our textbook (ie: structured similarly to those in HW #1 and HW #2)
- 1 questions pertaining to concepts, examples, or topics emphasized in our lecture slides and in-class labs
- 1 question involving a graph that appeared in media (ie: similar to our daily graph discussions)

Question #1 (textbook style)

A 2015 study published in the journal *SLEEP*, found that just one session of cognitive behavioral therapy can help people with insomnia. In the study, 40 people who suffered from insomnia were randomly divided into two groups of 20 each. One group participated in a one-hour therapy session, while the other did not receive any treatment. Three months later, 14 people in the therapy group reported improved sleep, but only 3 in the other group reported an improvement.

Part A: What are the cases in this study? Explain in 1-2 sentences.

Part B: What are the variables in this study? Name them and identify each as either categorical or quantitative.

Part C: If these data were laid out in spreadsheet form, with the cases as rows and the variables as columns, how many rows and columns would this spreadsheet contain?

Part D: Of the variables you described in Part B, identify the explanatory and response variable. Is there an association between these two variables? Justify your answer.

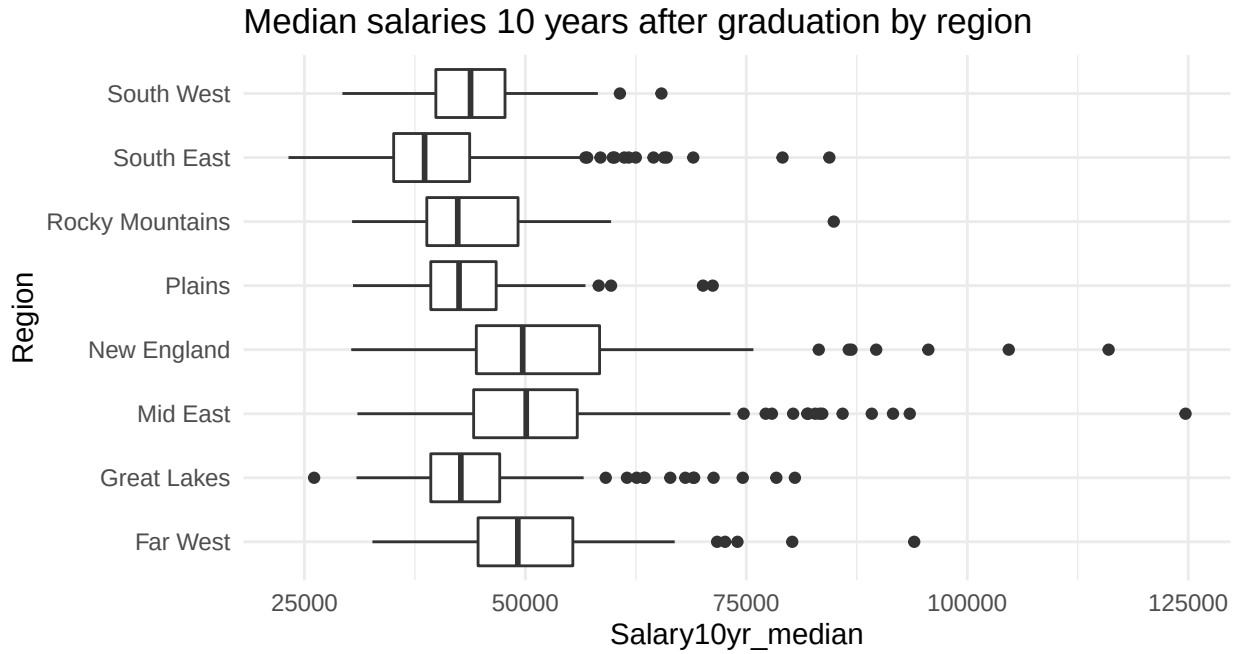
Part E: Briefly explain, describe, or sketch an appropriate graph that could be used to depict the relationship between the explanatory and response variable in this study.

Table 1: Comparative summary of the median salaries of students from 1095 different colleges and universities according to geographic region

Region	N	Mean	StDev	Median	IQR
Far West	104	50219.23	9733.817	49150	10725
Great Lakes	189	44270.90	8601.568	42700	7800
Mid East	198	51827.27	12804.237	50100	11725
New England	71	54560.56	16658.353	49700	13950
Plains	126	43223.02	6608.941	42500	7400
Rocky Mountains	30	45030.00	10539.095	42350	10325
South East	293	40194.88	8461.258	38600	8600
South West	84	44022.62	6700.339	43800	7825

Question #2 (lecture/lab style)

Presented below are data from 2019 describing 1095 different colleges or universities located in the United States.



Part A: Is there an association between the variables "Region" and "10 Year Salary"? Briefly explain (1-2 sentences).

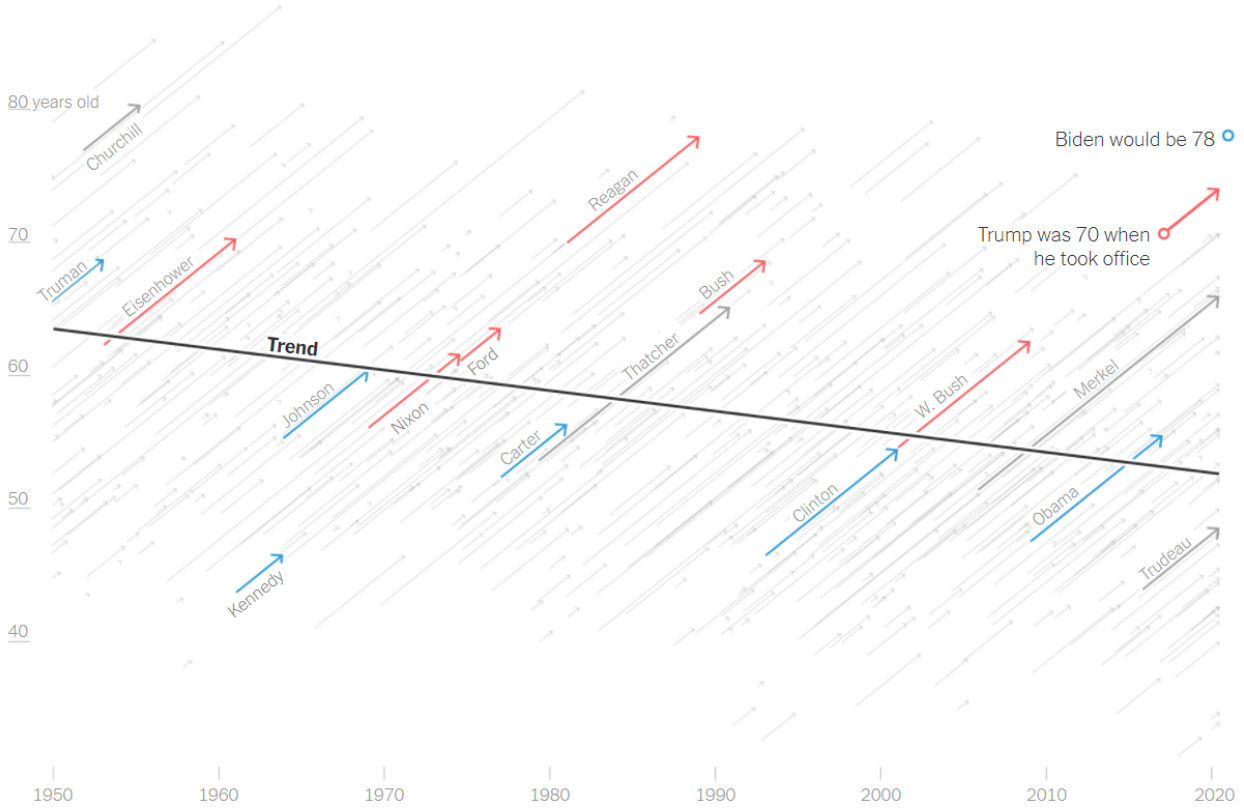
Part B: Overall, would the distribution of the variable "10 Year Salary" be more accurately described as right-skewed or left-skewed? Briefly explain (1-2 sentences).

Part C: Which region exhibits the greatest amount of variability in the median 10-year salaries of colleges/universities located within it? Justify your answer.

Part D: Briefly explain one way in which the *ecological fallacy* could occur in an interpretation of these results? (no more than 3 sentences)

Question #3 (daily graph style)

This graph shows the ages of presidents and prime ministers of 36 democratic nations while they were in office. It originally appeared on NYTimes.com shortly before the election of Joe Biden.



Note: Chart shows presidents and prime ministers of democratic nations in the O.E.C.D. as of March, excluding Switzerland, as of the day they took office. Source: OEF Research

Part A: What are the cases shown in this graph? What variables are depicted for each case?

Part B: Why do you think the creator of this graph used arrows rather than dots to depict each president or prime minister? (Hint: think about what the length of each of these arrows represents)

Part C: What appears to be happening to the typical age of presidents and prime ministers of democratic nations over time? Explain in 1-2 sentences.

Part D: Is statistically justifiable to conclude that the next US president will most likely be 55 or younger when they take office? Explain in 1-2 sentences.