

1. Figure 1 is a box and whiskers plot of the number of vehicles (in 1000s) produced in the year 2000 by the 29 largest vehicle producing countries. (source: The World Almanac and Book of Facts, 2002). The five number summary values are listed on the plot. For each of the following statements, tell whether it is (i) supported by either the plot or the statements made above, (ii) contradicted by either the plot or the statements made above, or (iii) undecidable from the plot and statements made above. Justify your answers.

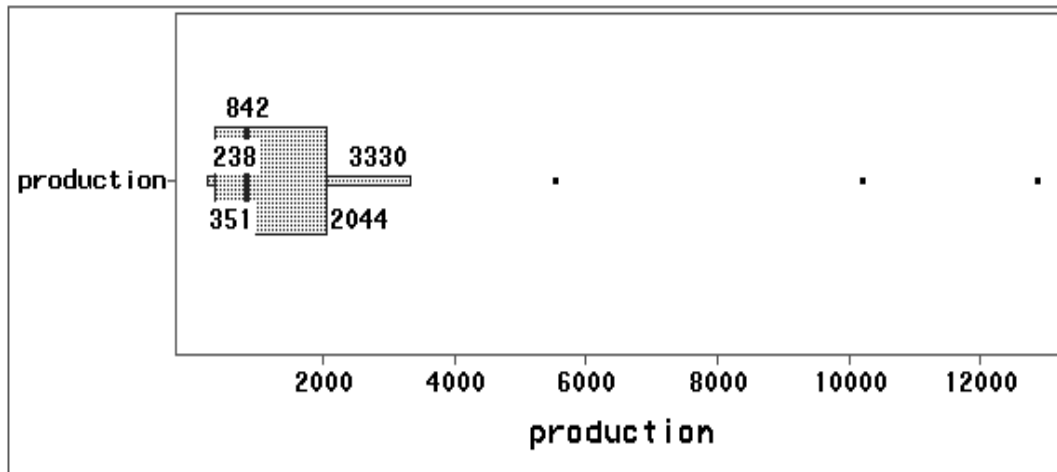


Figure 1: *Box and whiskers plot of vehicle production for the year 2000.*

- (a) (10 points) The smallest data value is 238.
- (b) (10 points) One of the data values equals 842.
- (c) (10 points) The the mean and standard deviation are more appropriate measures of location and spread than are the median and interquartile range.
- (d) (10 points) There is at least one data value greater than 2044 and less than 3330.
2. Faster magnetic resonance imaging (MRI) scanning has made MRI a potential cost-effective replacement for radiographic imaging for patients with low back pain. However, whether rapid MRI scanning results in better patient outcomes than radiographic evaluation or is a cost-effective alternative is unknown. An article in the June 4, 2003 issue of the Journal of the American Medical Association describes a study to determine the clinical and economic consequences of replacing spine radiographs with rapid MRI for primary care patients. The study looked at 380 patients aged 18 years or older whose primary physicians had ordered that their low back pain be evaluated.
- Suppose the 380 patients were assigned by the investigators to have rapid MRI or radiographic evaluation.
- (a) (10 points) What kind of study is this? Be as specific as you can. Justify your response.
- (b) (10 points) How should the subjects in the study be chosen so that the results of the study are to be applicable to all patients aged 18 years or older whose primary physicians order that their low back pain be evaluated?
- (c) (10 points) How should the patients be assigned to the rapid MRI or radiographic evaluation groups? Justify your answer.
- (d) (10 points) Give one example of how blocking could be used to improve the study results. Tell how your choice would improve the results.

- (e) (10 points) If the results show a difference in patient outcomes between the rapid MRI and radiograph groups, can we conclude that the difference is due to which type of imaging was used? Justify your answer.
3. (10 points) Figure 2 is a needle plot of the lifetimes, in days, of 70 switching relays in continuous use from their installation on May 1, 1970. Bob claims the plot demonstrates the stationarity of the process that produced them. Do you agree? Justify your answer.

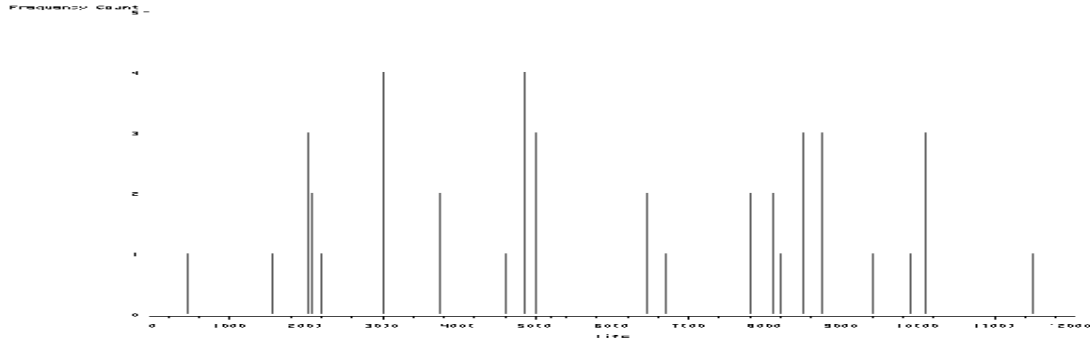


Figure 2: *Needle plot of switching relay lifetimes.*