Question 1 Scoring Guidelines

4 Complete Response

Correctly uses the graph or (informally) interpolates in the table to approximate the medians and quartiles. The numerical values must make practical sense within the context of the problem.

Approximates medians for 1900 to be about 23 or 24 and for 2000 about 35 or 36.

Approximates the interquartile ranges for 1900 to be about 40 - 12 = 28 and for 2000 about 54 - 18 = 36.

May not calculate the IQR but gives a clear indication in the writing that the distance between the quartiles is a measure of spread.

States clearly that the U.S. age distribution will shift toward larger values for 2000 as compared to 1900, with greater variability in 2000. The statement is consistent with the numerical results from parts (a) and (b) and is written in such a way that it would be understood by the general population.

3 Substantial Response

Approximates medians and interquartile ranges nearly correctly from the graph or the table. Need not calculate the IQR if there is some indication that the quartiles can measure variability.

States clearly that the U.S. age distribution will shift toward larger values for 2000 as compared to 1900, but may not specifically mention the increase in variability.

2 Developing Response

Gives a poor approximation for the medians or interquartile ranges, but seems to have some understanding of what these measures represent.

Or, provides at least a weak but correct statement on the nature of the changing populations.

1 Minimal Response

Indicates some understanding of at least one of the three parts of the question.

Sample 1

(a) Approximate the median age for each distribution.

1900

$15 < $ median age < 25

median age ≈ 22.5 yrs

2000

$35 < $ median age < 45

median age ≈ 36 yrs

(b) Approximate the interquartile range for each distribution.

1900

.25   .75

$10\text{-}11 \leq x \leq 39$

$39 - 11 = \boxed{28\,yrs}$ size

$\boxed{11 \Rightarrow 39}$
values

2000

.25   .75

$18 \leq x \leq 53$ values

$53 - 18 = \boxed{35\,yrs}$ size

(c) Using the results from parts (a) and (b), write a sentence or two for a history textbook comparing the age distributions for the years 1900 and 2000.

At the turn of the century in 1900, the age of people was much lower than it will be when we hit the year 2000. In 1900 the median age was only 22 + 23 years old while in the year 2000 it will be about 36. People are living longer now. The middle 50% of people in 1900 were between 11 and 39 years old while in 2000 the middle 50% will be between 18 and 53 years old.

(a) Approximate the median age for each distribution.

The median age for each distribution would appear at the age where 50% of the population was at or below that age. In the case of 1900, the approx. median age was close to 25 yrs. of age, with 54.4% of the population being at or below the age of 25. For the 2000 distribution the approx. median age was slightly above 35 yrs., with 48% of the population at or below the age of 35.

(b) Approximate the interquartile range for each distribution.

The interquartile range is equivalent to the range of the ages in the middle 50% of each population distribution. Thus it can be found by subtracting the 25% age (approx.) from the 75% age (approx.)

estimated
from
graph...

1900: approx. 25% - 12 yrs.
      approx. 75% - 40 yrs. → 40 yrs - 12 yrs = 28 yrs.

2000: approx. 25% 20 yrs.
      approx. 75% - 35 yrs. → 55 yrs - 20 yrs = 35 yrs.

The approx. IQR for 1900 is 28 yrs., while for 2000, it is 35 yrs.

(c) Using the results from parts (a) and (b), write a sentence or two for a history textbook comparing the age distributions for the years 1900 and 2000.

In the year 2000, the population, as a whole will be older than it was in the year 1900, as can be based on the medians. The spread of the population ages, will also be fairly different, as is demonstrated by the IQRs. In the year 2000, the ages of the population will be spread more widely relative to the population in 1900.

Commentary:

The thinking of this student is clearly stated in words; the reasoning on both the medians and the interquartile ranges is correct. The conclusion concisely states how both the center and spread of the ages increase between 1900 and 2000. *Score = 4*

Sample 3

(a) Approximate the median age for each distribution.

The median age for the population of 1900 lies between the ages of 15 and 25, where 50% of the population is above & below the median. This age is contained in (15,25), roughly 23.

The median age for the 2000 population lies between the ages of 35 and 45, roughly 37.

(b) Approximate the interquartile range for each distribution.

The IQR is $Q_3 - Q_1$. For 1900, $Q_3 \approx 37$ and $Q_1 \approx 10$. Therefore, the IQR ≈ 27 years

For 2000, $Q_3 \approx 53$ and $Q_1 \approx 17$. Therefore, the IQR ≈ 36 years

(c) Using the results from parts (a) and (b), write a sentence or two for a history textbook comparing the age distributions for the years 1900 and 2000.

During the year 1900, the majority of the U.S. population ranged from the ages of 10 to 37, while in the year 2000, the population ranged from 17 to 53 years old. In general, the age of the "average" American citizen has increased dramatically.

Commentary:

Correct reasoning and good approximations are provided for both the medians and the interquartile ranges. Although the conclusion states that ages are increasing, the use of interquartile ranges to express this idea is a bit confused. Both the "majority" and "population ranged" terms are not quite correct. *Score = 3*