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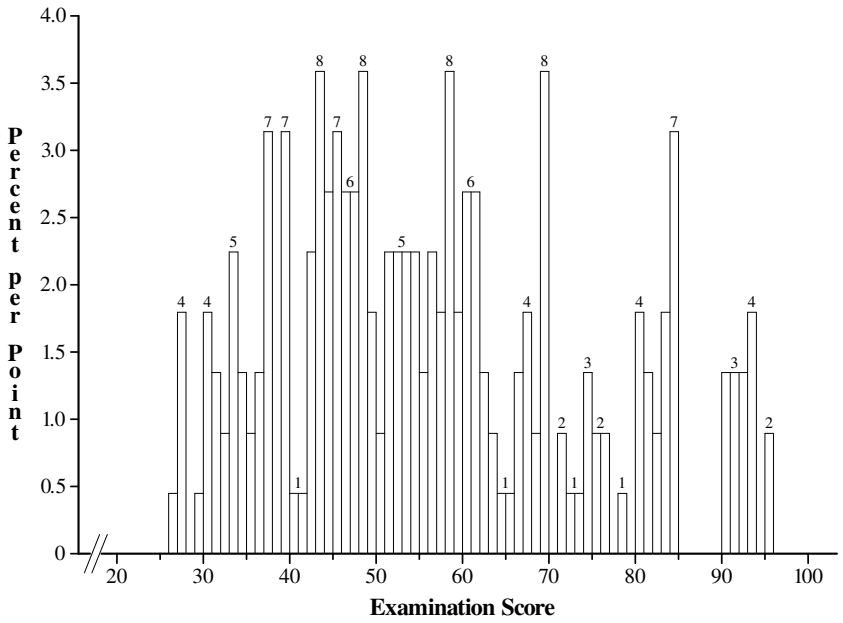
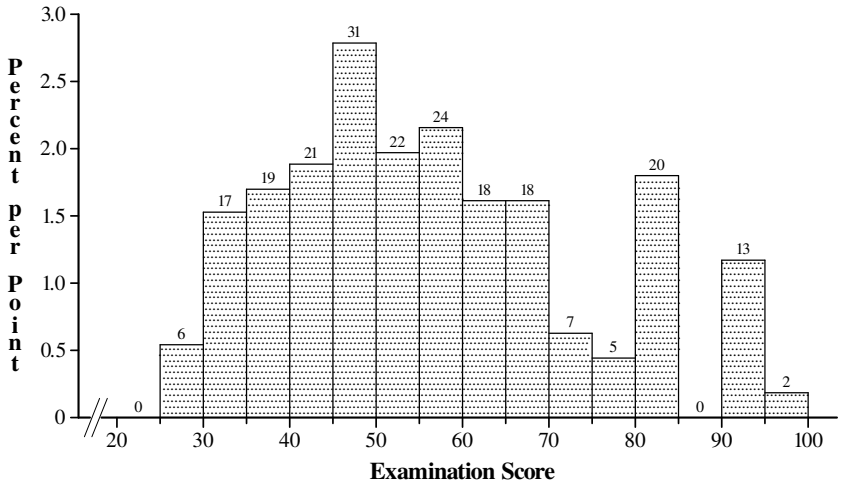
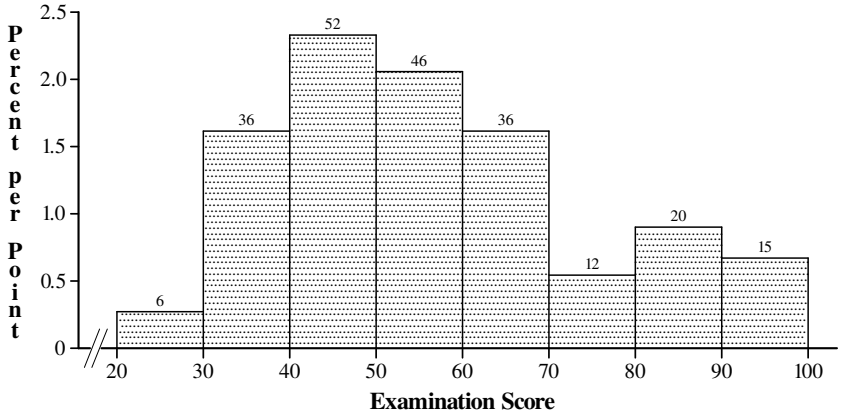
# GRAPHICAL ATTRIBUTES: Histograms – Civil Service Examination Scores

In the Sanitary District of Chicago in early 1966, there were 15 job openings for operating engineers. On March 12, 223 male applicants for the jobs wrote a civil service examination; the minimum passing grade was 70. The scores on the examination, arranged in increasing order, are given below. On the basis of these scores, Vinton W. Bacon, superintendent of the Sanitary District, suspected irregularities in the examination; subsequent investigation confirmed that the reported results did not honestly reflect individual performances on the examination – possible culprits were certain examinees, the people responsible for the examination, or those who reported the results. Three histograms of the scores are shown at the right, based on interval widths of 1, 5 and 10 points; marks corresponding to the left-hand edge of each bar are *in*cluded in the bar, those corresponding to the right-hand edge are *ex*cluded.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 27 | 27 | 27 | 27 | | 29 | 30 | 30 | 30 | 30 |
| 31 | 31 | 31 | 32 | 32 | | 33 | 33 | 33 | 33 | 33 |
| 34 | 34 | 34 | 35 | 35 | | 36 | 36 | 36 | 37 | 37 |
| 37 | 37 | 37 | 37 | 37 | | 39 | 39 | 39 | 39 | 39 |
| 39 | 39 | 40 | 41 | 42 | | 42 | 42 | 42 | 42 | 43 |
| 43 | 43 | 43 | 43 | 43 | | 43 | 43 | 44 | 44 | 44 |
| 44 | 44 | 44 | 45 | 45 | | 45 | 45 | 45 | 45 | 45 |
| 46 | 46 | 46 | 46 | 46 | | 46 | 47 | 47 | 47 | 47 |
| 47 | 47 | 48 | 48 | 48 | | 48 | 48 | 48 | 48 | 48 |
| 49 | 49 | 49 | 49 | 50 | | 50 | 51 | 51 | 51 | 51 |
| 51 | 52 | 52 | 52 | 52 | | 52 | 53 | 53 | 53 | 53 |
| 53 | 54 | 54 | 54 | 54 | | 54 | 55 | 55 | 55 | 56 |
| 56 | 56 | 56 | 56 | 57 | | 57 | 57 | 57 | 58 | 58 |
| 58 | 58 | 58 | 58 | 58 | | 58 | 59 | 59 | 59 | 59 |
| 60 | 60 | 60 | 60 | 60 | | 60 | 61 | 61 | 61 | 61 |
| 61 | 61 | 62 | 62 | 62 | | 63 | 63 | 64 | 65 | 66 |
| 66 | 66 | 67 | 67 | 67 | | 67 | 68 | 68 | 69 | 69 |
| 69 | 69 | 69 | 69 | 69 | | 69 | 71 | 71 | 72 | 73 |
| 74 | 74 | 74 | 75 | 75 | | 76 | 76 | 78 | 80 | 80 |
| 80 | 80 | 81 | 81 | 81 | | 82 | 82 | 83 | 83 | 83 |
| 83 | 84 | 84 | 84 | 84 | | 84 | 84 | 84 | 90 | 90 |
| 90 | 91 | 91 | 91 | 92 | | 92 | 92 | 93 | 93 | 93 |
| 93 | 95 | 95 | | | | | | | | |




**DATA SOURCE:** May, J.D. and Bemesderfer, K.J.:
*Social and Political Enquiry.*
Duxbury Press and Wadsworth Publishing Company, Inc., Belmont, California, 1972, pages 5-6.



(*continued overleaf*)

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1 In light of the background information about the examination scores given overleaf on page HL25.1, describe briefly the noteworthy features of the data as they are portrayed in the three histograms. Give your answer in point form in a way that makes clear why superintendent Bacon's suspicions were aroused.

- Compare and contrast the histograms for the three different interval widths as pictorial presentations of the data set of examination scores.

2 It is widely believed that the *normal* distribution is an appropriate probability model for examination scores. Discuss briefly the relevance, if any, to this belief of the data overleaf on page HL25.1.

Another illustration (though less striking than that overleaf on page HL25.1) is provided by two histograms (with the *same* interval width but *different* starting values) of the data set of 66 observations in Question **A2 – 1** on the STAT 220 assignments.

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