SOLUTIONS MANUAL AND TEST BANK

STATISTICAL QUALITY CONTROL WITH MICROCOMPUTER APPLICATIONS

LARRY E. SHIRLAND

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TO ACCOMPANY

STATISTICAL QUALITY CONTROL WITH MICROCOMPUTER APPLICATIONS

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CONTENTS

CHAPTER 1

DISCUSSION QUESTIONS

1. What is the meaning of quality?

   Quality means different things to different people. In this text quality is defined in at least two ways. Students should be able to find many other definitions in current literature.

   a. The overall subjective perception of how good a product or service is as determined by consumers.

   b. Conformance to specifications.

2. When you think of quality, what products come to mind? Discuss why you feel these products represent quality.

   Some possible products that are perceived to be high in quality might include Rolex watches, Rolls Royce automobiles, Mercedes automobiles, Toyota automobiles, Maytag washers, Ralph Lauren clothes, IBM computers, Leica cameras, filet mignon, Nike shoes and L.L.Bean products.

   Often perceived quality is tied directly to price, expecially in relation to Rolls Royce and Rolex. These products fit the "quality of design" aspect of quality. Toyota automobiles may be considered high quality because of their reliability, low repair rates and absence of defects. Other products may be considered high in quality because of excellent customer service such as L.L. Bean products.

3. To what do you attribute the decline of quality in the United States?

   Some of the reasons involve the preeminence of the U.S.A. as a producer of product during and shortly after World War II. Nearly everything produced in the U.S.A. could be sold and therefore; there was no need for quality, only quantity. As the Japanese began to rebuild after the war they used quality as their competitive advantage. They began to stress quality while the U.S.A. was involved in military operations in Viet Nam and other countries. Complacency caused the decline as much as any reason. The U.S. is still trying to catch up while the competition is continually trying to improve their products and services.

4. Define potential specifications for the following products.

   The following specifications are things that a consumer might impose. Some of the listed specifications would have to be operationalized or defined in terms of how they were going to be measured.

   a. An automobile. In addition to specifications on the dimensions of various components, customer specifications might include:

      The gas mileage should be 30 m.p.g. or more.
      There should be no mechanical or aesthetic defects.

The tires should be inflated to 30 plus/minus 5 psi.
The vehicle should not rust out within six years.

b. A fast food hamburger:
The quality should be consistent from burger to burger.
A 1/4 pounder should weigh 1/4 pound plus/minus 0.1 ounce.
A burger should contain no foreign particles.

c. A computer:

There should be no cosmetic defects.
It should operate for 5 years without major repair.
The keys should not stick.
It should boot itself within 1 minute of being turned on.

d. Operations of a bank:

Bank transactions should be perfectly accurate.
Service time should begin no later than 3 minutes from entering the bank.
The automatic teller should be available 24 hours per day.
Bank personnel should be personable.

5. Discuss a current newspaper or magazine article dealing with quality.

Exercise left to the student.

CHAPTER 2

DISCUSSION QUESTIONS

2-1. Why is statistical analysis important in quality control?

Statistical concepts are used to determine the capability of a process, to establish control chart limits, to make inferences about a process, and to design sampling plans. Costly mistakes can be avoided by using statistical analysis to monitor and control processes. Statistical analysis provides a foundation for continuous improvement of processes.

2-2. What is a continuous random variable? Give Examples.

A continuous random variable is any measureable characteristic such as weight, miles per gallon or students' grade point averages. A continuous random variable for a process is any value within the range of possible values for that process.

2-3. What is a discrete random variable? Give examples.

A discrete random variable is a measureable characteristic that can take on only integer values. For example, the number of defective items found in a sample of 100 items and the number of surface blemishes in an item being inspected are discrete random variables.

2-4. Of what use are frequency distributions in quality control?

Frequency distributions are invaluable in the study of variation in a process. An examination of a frequency distribution can tell whether the process is normally distributed, whether there is more than one peak (mode), and whether the data are skewed to the left or right. Frequency distributions provide a means to examine data from a process with an objective of determining the capability of a process and whether the process can meet specifications.

2-5. Why are too many cell categories undesirable when constructing frequency distributions and histograms? Too few?

Too many cell categories will not give a good representation of the data because many cells will have few or even no values within the category. With too few categories the general shape of the data will be lost and little valuable information will be gained in regard to variation in the data. The computer programs supplied with this text allow for experimentation with the number of cell categories to find the best representation of the data.

2-6. Under what conditions might you prefer to use an ogive instead of a histogram or frequency polygon?

An ogive might be preferred when the user would like to view cumulative relative frequencies. The ogive allows one to quickly determine the percentage of values less than a specified value. For example, in Figure 2.3 for example 2-1 the percentage of rolls of Sure-Stik Tape having a strength of 124.8 pounds or less (category 11) can be read from the ogive as approximately 0.46 or 46 percent.

2-7. What are the major benefits of having computer programs to generate frequency distributions, histograms, frequency polygons, and ogives?

Computer programs relieve the user from tedious calculations. They allow for experimentation with cell categories that could not easily be done by hand. They also produce charts and graphs quickly.

PROBLEMS

2-1. a. See graphs and tables

b. See graphs and tables

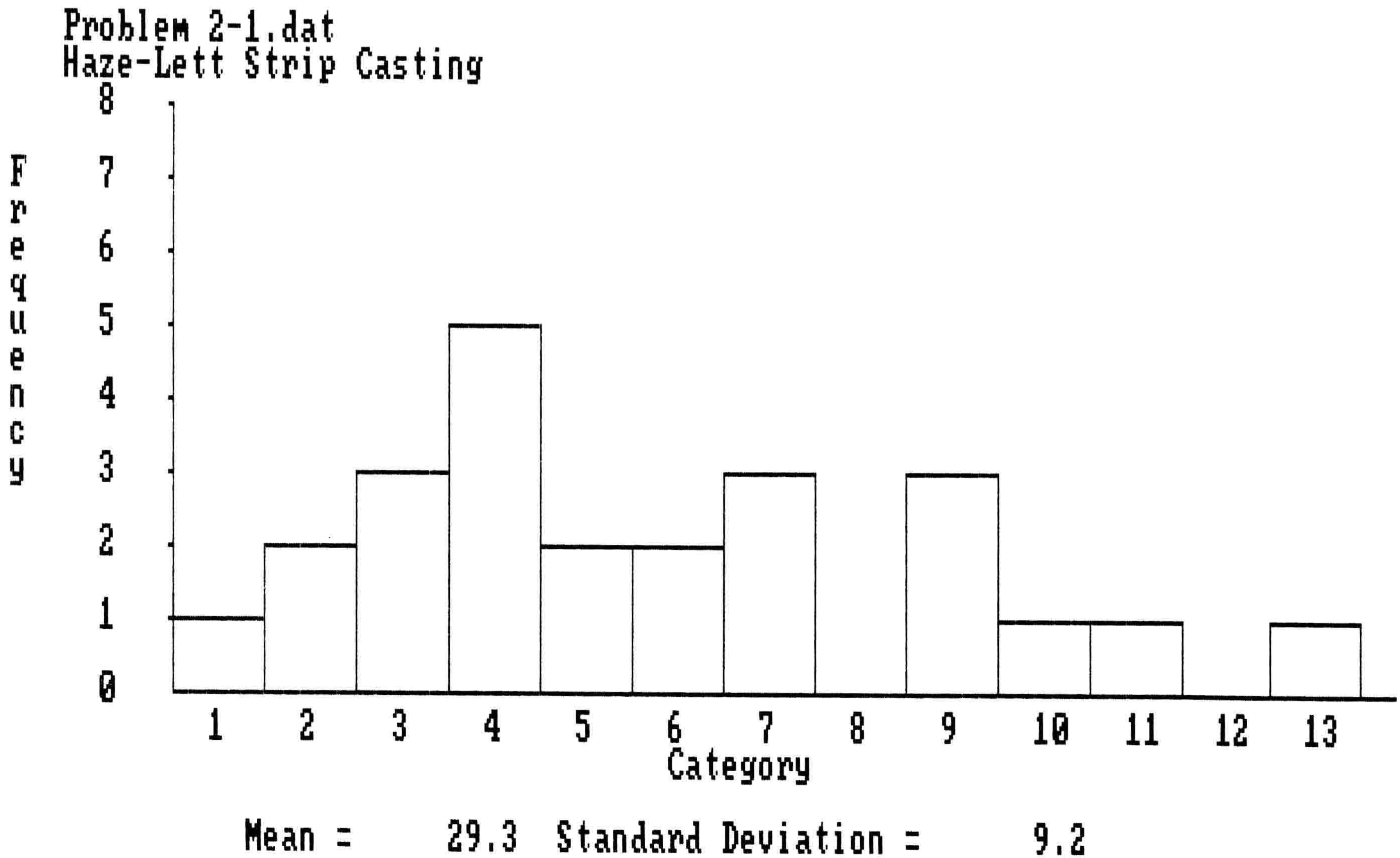
c. See graph and table for 10 cell categories with an increment of 4.0 and a midpoint for cell 1 of 15.0.

2-1a.

Problem 2-1.dat
Haze-Lett Strip Casting

Category	Cell Boundary			Midpoint	Freq.	Rel. Freq.	Cum. Freq
1	13.9	-	16.8	15.4	1	0.0417	0.0417
2	16.9	-	19.8	18.4	2	0.0833	0.1250
3	19.9	-	22.8	21.4	3	0.1250	0.2500
4	22.9	-	25.8	24.4	5	0.2083	0.4583
5	25.9	-	28.8	27.4	2	0.0833	0.5417
6	28.9	-	31.8	30.4	2	0.0833	0.6250
7	31.9	-	34.8	33.4	3	0.1250	0.7500
8	34.9	-	37.8	36.4	0	0.0000	0.7500
9	37.9	-	40.8	39.4	3	0.1250	0.8750
10	40.9	-	43.8	42.4	1	0.0417	0.9167
11	43.9	-	46.8	45.4	1	0.0417	0.9583
12	46.9	-	49.8	48.4	0	0.0000	0.9583
13	49.9	-	52.8	51.4	1	0.0417	1.0000
				Total	24		

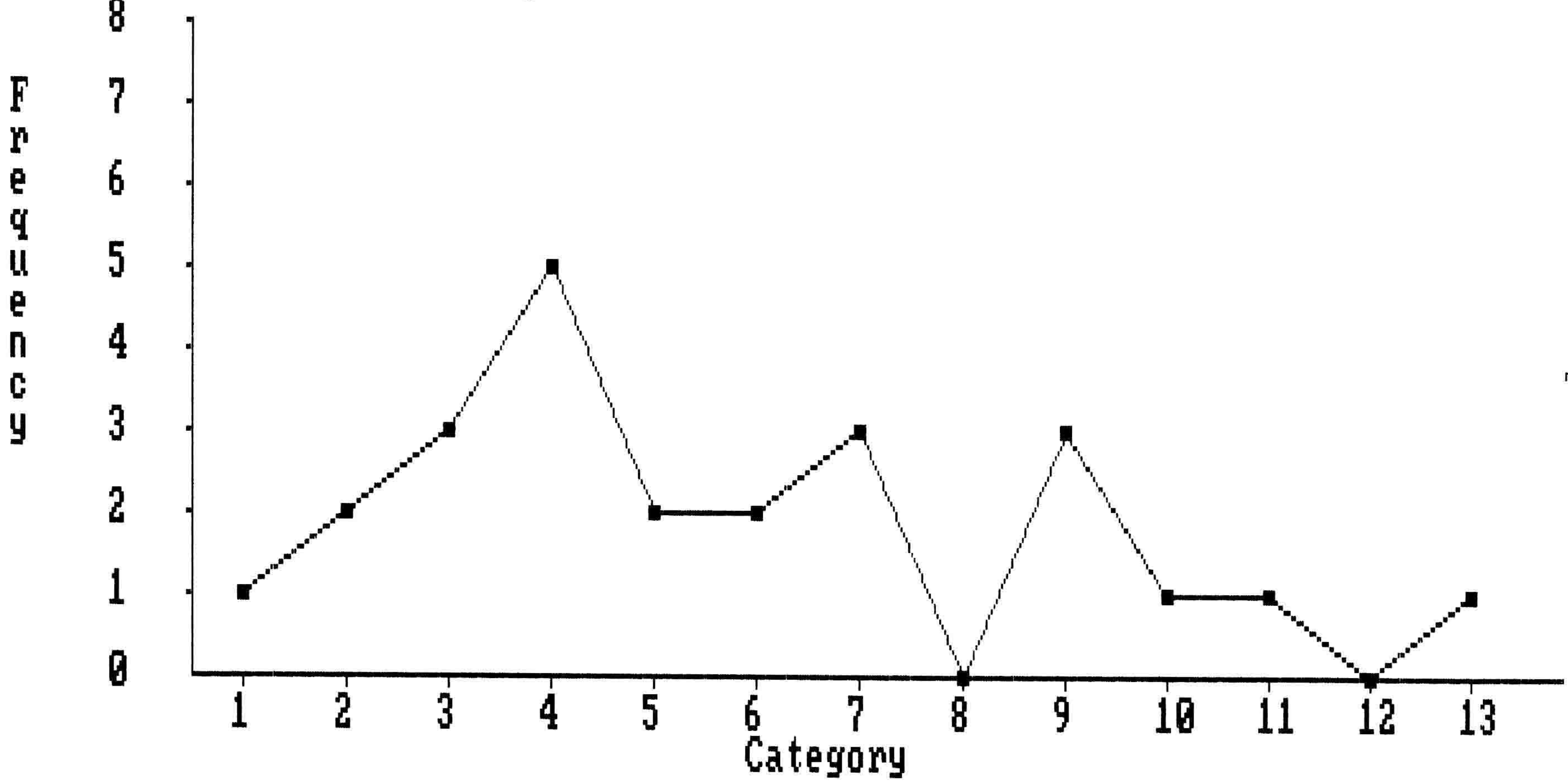
2-1a.



Problem 2-1.dat
Haze-Lett Strip Casting
Frequency
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
8
9
10
11
12
13
Category
Mean = 29.3 Standard Deviation = 9.2

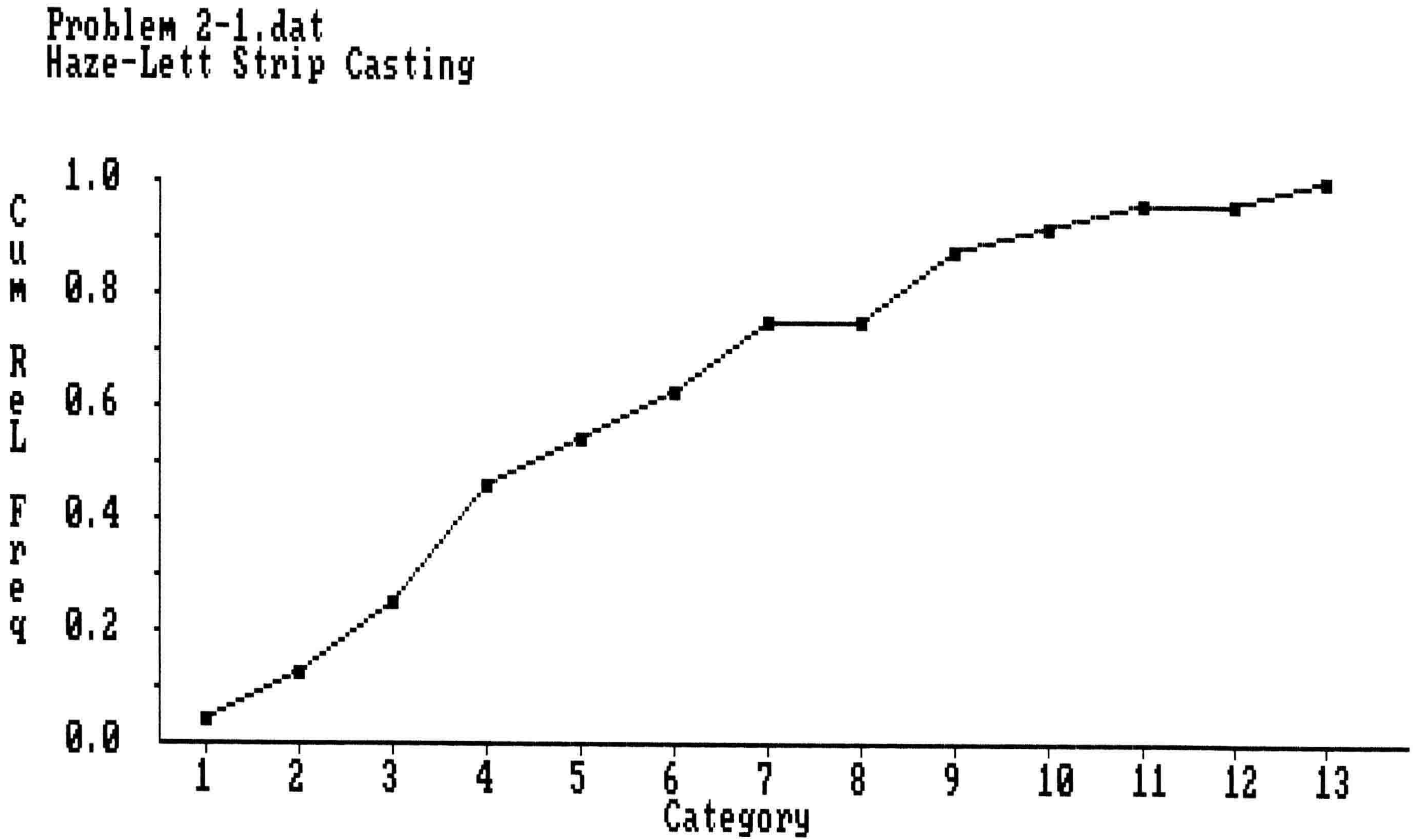
2-1a.

Problem 2-1.dat
Haze-Lett Strip Casting



Mean = 29.3 Standard Deviation = 9.2

2-1a.


Problem 2-1.dat
Haze-Lett Strip Casting
Cum ReL Freq
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
8
9
10
11
12
13
Category

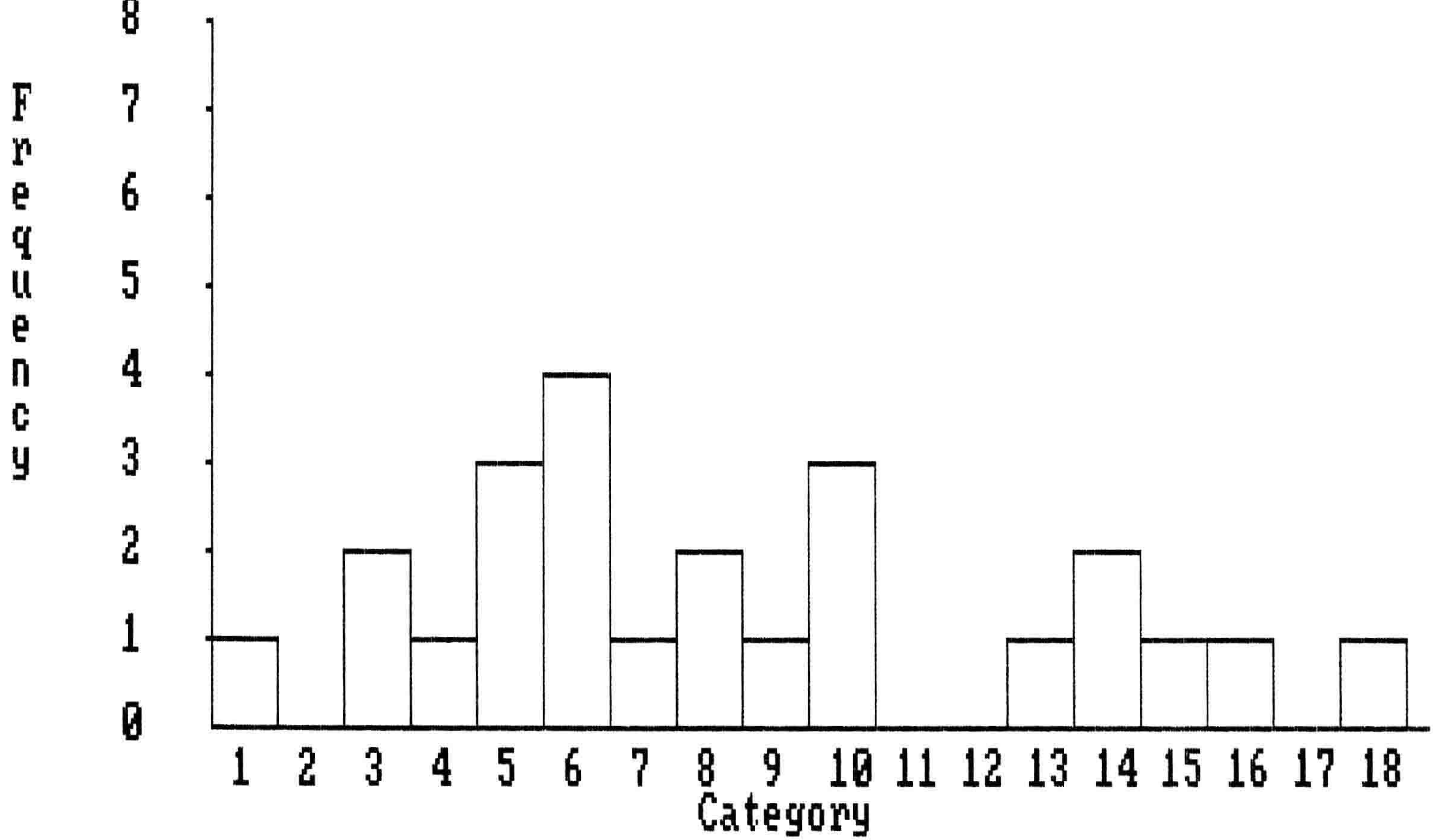
2-1b.

Problem 2-1.dat
Haze-Lett Strip Casting

Category	Cell Boundary			Midpoint	Freq.	Rel. Freq.	Cum. Freq
1	14.0	-	15.9	15.0	1	0.0417	0.0417
2	16.0	-	17.9	17.0	0	0.0000	0.0417
3	18.0	-	19.9	19.0	2	0.0833	0.1250
4	20.0	-	21.9	21.0	1	0.0417	0.1667
5	22.0	-	23.9	23.0	3	0.1250	0.2917
6	24.0	-	25.9	25.0	4	0.1667	0.4583
7	26.0	-	27.9	27.0	1	0.0417	0.5000
8	28.0	-	29.9	29.0	2	0.0833	0.5833
9	30.0	-	31.9	31.0	1	0.0417	0.6250
10	32.0	-	33.9	33.0	3	0.1250	0.7500
11	34.0	-	35.9	35.0	0	0.0000	0.7500
12	36.0	-	37.9	37.0	0	0.0000	0.7500
13	38.0	-	39.9	39.0	1	0.0417	0.7917
14	40.0	-	41.9	41.0	2	0.0833	0.8750
15	42.0	-	43.9	43.0	1	0.0417	0.9167
16	44.0	-	45.9	45.0	1	0.0417	0.9583
17	46.0	-	47.9	47.0	0	0.0000	0.9583
18	48.0	-	49.9	49.0	1	0.0417	1.0000
				Total	24		

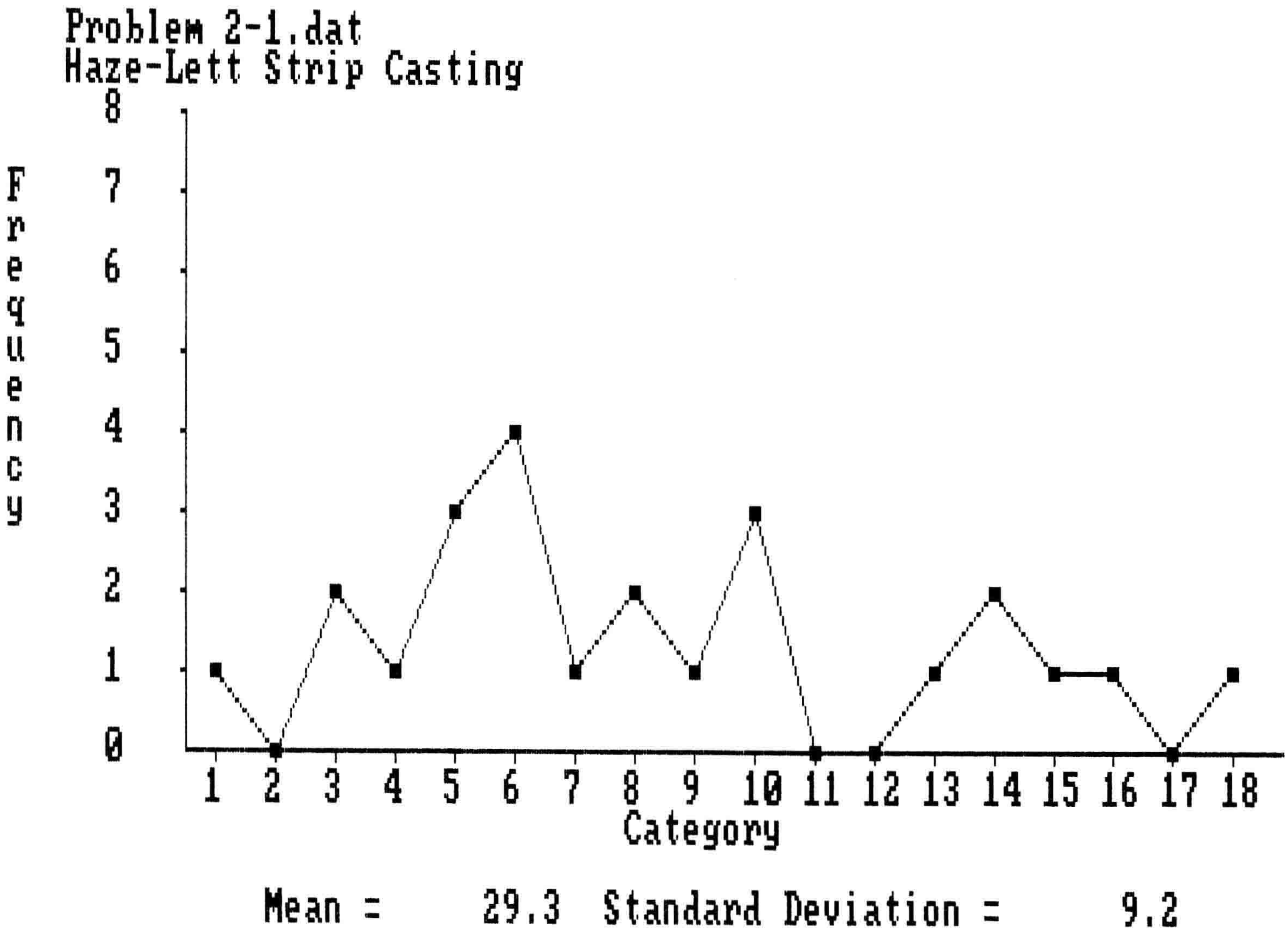
2-1b.

Problem 2-1.dat
Haze-Lett Strip Casting



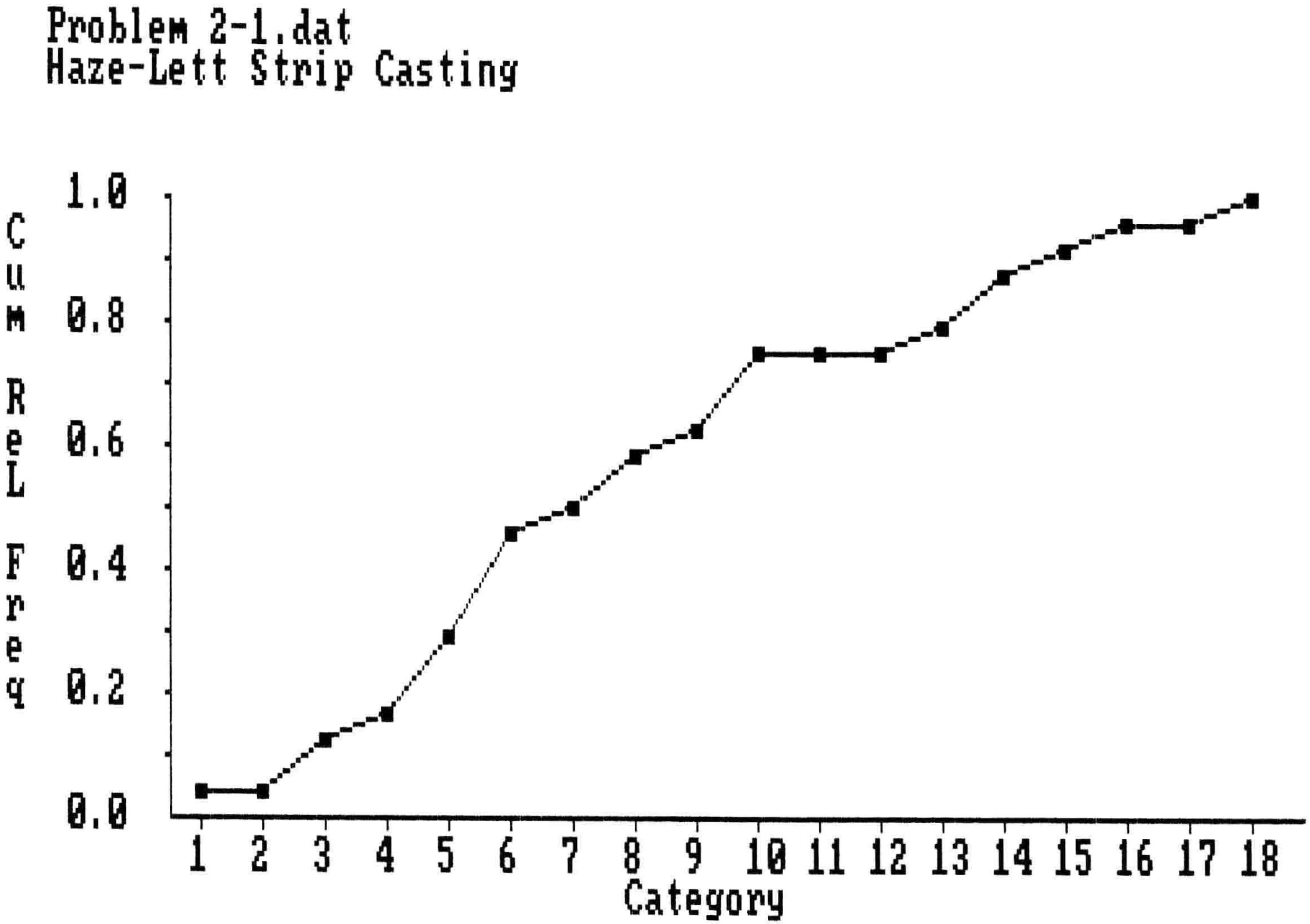
Mean = 29.3 Standard Deviation = 9.2

2-1b.



Problem 2-1.dat
Haze-Lett Strip Casting
Frequency
0 1 2 3 4 5 6 7 8
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Category
Mean = 29.3 Standard Deviation = 9.2

2-1b.


Problem 2-1.dat
Haze-Lett Strip Casting
Cum ReL Freq
1.0
0.8
0.6
0.4
0.2
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Category

2-1c.

Problem 2-1.dat
Haze-Lett Strip Casting

Category	Cell Boundary			Midpoint	Freq.	Rel. Freq.	Cum. Freq
1	13.0	-	16.9	15.0	1	0.0417	0.0417
2	17.0	-	20.9	19.0	2	0.0833	0.1250
3	21.0	-	24.9	23.0	5	0.2083	0.3333
4	25.0	-	28.9	27.0	5	0.2083	0.5417
5	29.0	-	32.9	31.0	4	0.1667	0.7083
6	33.0	-	36.9	35.0	1	0.0417	0.7500
7	37.0	-	40.9	39.0	3	0.1250	0.8750
8	41.0	-	44.9	43.0	1	0.0417	0.9167
9	45.0	-	48.9	47.0	1	0.0417	0.9583
10	49.0	-	52.9	51.0	1	0.0417	1.0000
				Total	24		