



SPC

LESSON: "Which Chart Am I?"

Instructions: The data for this set is in the file: **Hmwk8DATA_WhichChart**.

Problem 0. For each of the following, select the **most** appropriate chart to use.

1. Average bolt torque for 4 bolts on a transmission coming off an assembly line

Xbar-R I-MR *p or np* *c or u*

2. Number or proportion of missing bolts per 8 on an engine

Xbar-R I-MR *p or np* *c or u*

3. Number of typos per sales contract

Xbar-R I-MR *p or np* *c or u*

4. Number of defects on an engine

Xbar-R I-MR *p or np* *c or u*

5. Amount of time it takes to build an engine

Xbar-R I-MR *p or np* *c or u*

6. Number or proportion of defective engines made per month given that we know how many engines are produced

Xbar-R I-MR *p or np* *c or u*

7. Number of engine recalls per month

Xbar-R I-MR *p or np* *c or u*

8. Amount of time it takes to close a sales account

Xbar-R I-MR *p or np* *c or u*

9. The number of customer complaints in a week

Xbar-R	I-MR	p or np	c or u
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10. The number or proportion of defective bolts in a 64-pack

Xbar-R	I-MR	p or np	c or u
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11. The average weight of four engines coming off an assembly line

Xbar-R	I-MR	p or np	c or u
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12. The number of plant accidents in a month

Xbar-R	I-MR	p or np	c or u
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13. The time it takes to tour an engine assembly plant

Xbar-R	I-MR	p or np	c or u
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14. The number or proportion of daily workers taking a sick day given we know how many daily workers there are

Xbar-R	I-MR	p or np	c or u
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Problems 1-7: For the following problems, some have data provided in the Minitab worksheet Hmwk8DATA_WhichChart that will help you make a choice as to the correct control chart to use.

Problem 1. Piston Ring Nonconformance Rates: A manufacturer of piston rings wants to reduce the number of nonconforming rings that are produced each day.

Data Collection: Each day, the team inspects every piston ring that is produced and records the total number of nonconforming rings along with the total number of rings produced.

Each piston ring is rated as a:

- Success, if it meets specifications
- Failure, if it does not meet specifications

Please refer to the Minitab worksheet of data before making your choice.

Data Set: Description of variables and data contained in the Minitab worksheet for Homework 8:

Variable	Description
C1: Date	Date the piston rings were manufactured
C2: Defective Units	Number of defective rings for each date
C3: Sample Size	Number of rings produced and inspected for each date

Circle the correct chart to use:

Xbar-R

I-MR

 p np c u

Problem 2. Bad Bills: A study was undertaken on the billing process at an electric company which had been experiencing complaints from customers about their quarterly billing system (such as incorrect amounts, no bill included, wrong address, damaged envelopes). Samples of 500 bills were examined and the number of "bad" bills was recorded.

The results of 20 such samples (in column C5) were:

15	12	15	10	7	13	11	14	22	18	19	16	14
20	18	12	8	15	19	16						

Let X be a random variable that represents the **number of bad bills out of 500**. I would use an np chart (number of defective items per lot), but you could use a c chart (number of defects per unit, where "unit" is a batch of 500 bills). It is "more" correct to use the np (or p) chart since you know the TOTAL number of bills.

Construct both the np and c charts. Which chart would give the company less of a chance of a Type I Error, but more of a chance of a Type II Error? You do not need to attach your charts.

Problem 3. Vinyl Defects: You are manufacturing sheet vinyl that will be used for automobile upholstery. You plan to chart defects per 100 ft. of sheet vinyl. Which chart would you use to track the number of defects per 100 ft.?

Circle the correct chart to use:

Xbar-R

I-MR

 p np c u

Problem 4. Furniture Blemishes: A furniture manufacturer is concerned about customer complaints related to surface blemishes, including color, scratches, dents, grain, and finish, on wooden end tables.

Data Collection: A quality team inspects each table for the nonconformities indicated above. For about 3 weeks, the team records the number of surface blemishes (and the number of pieces inspected).

Data Set: Description of variables and data contained in the Minitab worksheet for Homework 8.

Variable	Description
C7: Date_1	Date tables were manufactured
C8: Blemishes	Number of blemishes on each table

Circle the correct chart to use if just plotting nonconformities in column C8.

Xbar-R I-MR p np c u

Bonus: Column C9 has the number of tables inspected each day. If we use this additional information in constructing the control chart for the defect data in column C8, what type of control chart is appropriate?

Xbar-R I-MR p np c u

Problem 5. Inspecting Gear Assemblies: Each morning, the production supervisor of a gear assembly line reviews the production numbers from the previous day. If the percentage of defective assemblies is greater than the goal of 14%, the department goes on "red alert" status. An engineer, who is newly trained in Statistical Process Control (SPC), convinces the supervisor to collect the data over a trial period without acting on it, so that they can observe random variation.

Data Collection: Inspectors record the number of assemblies that are inspected and rejected each day over a two-month period. If the percentage is too high, the department will go on red alert.

Data Set: Description of variables and data contained in the Minitab worksheet for Homework 8.

Variable	Description
C11: Date/Time	Date the gears were manufactured
C12: Assemblies Inspected	The number of gear assemblies inspected each day
C13: Rejects	Number of rejects in each subgroup of assemblies

Circle the correct chart to use:

Xbar-R I-MR p np c u

Problem 6. Inspecting Gear Assemblies: Each morning, the production supervisor of a gear assembly line reviews the time it takes to assemble an engine. He tracks the individual assembly times & plots them.

Circle the correct chart to use:

Xbar-R I-MR p np c u

Problem 7. Greeting Card Quality: A greeting card printer implements a quality initiative to decrease the number of defects in its oversized cards. Before the initiative, the process was in statistical control. The printer compares pre- and post-initiative process performance and inspects the cards for smudges, orientation, color, and wrinkles.

Data Collection: Each day inspectors randomly sample 250 cards as a subgroup. They check each card and record the sample date, as well as the total number of nonconformities that are in each subgroup.

Data Set: Description of variables and data contained in the Minitab worksheet for Homework 8.

Variable	Description
C15: Dates	Date greeting cards were printed
C16: Flaws	Number of flaws observed in a sample of 250 greeting cards

Circle the correct chart to use:

Xbar-R I-MR p np c u

Problem 8. Suppose every morning (around 11 a.m.) that Square Donuts personnel sample 100 of it's "square" donuts to make sure that they are indeed square. They record the number out of 100 that are not actually square. That is, the "fail" the square test. They do this same test in the afternoon (around 4 p.m.). The data for the number of donuts that are defective (i.e., not square) out of 100 is stored in Column C19. The constant sample size is recorded in Column C20.

Circle the correct chart to use:

Xbar-R I-MR p np c u