

Math 1040, Spring 2007

Instructor: Alla Borisyuk

Review and practice problems for Midterm 1

(February 7, 2007; 8:35 to 9:25 am)

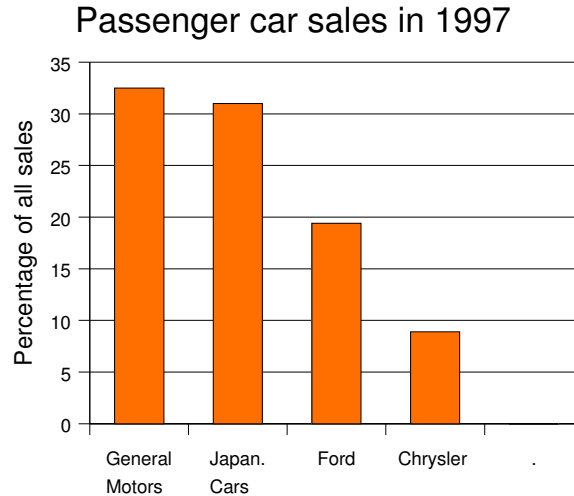
Please, keep in mind that the test may include any of the material that we encountered in class/homeworks, even if it does not directly appear in the practice problems.

Primary topics covered

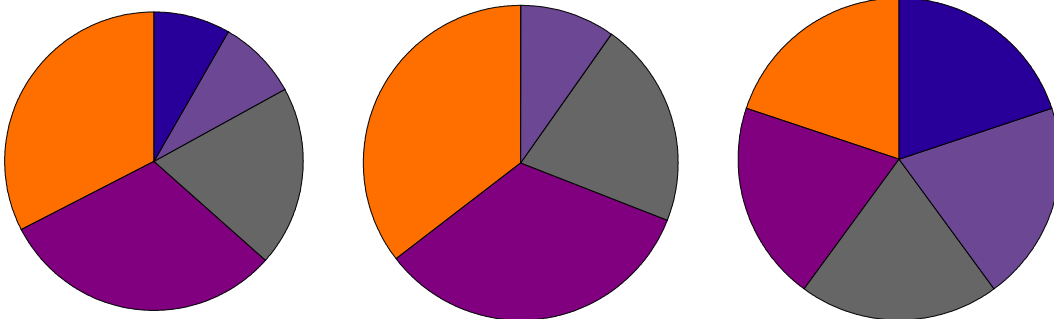
- Chapter 1: **Basic notions.** individuals, variables, sample, population, observational studies, census, experiments
- Chapter 3: **Basics of parameter estimation.** Parameter, statistic, relationship between them, margin of error
- Chapter 2, 3: **Sample surveys.** Bias and variability of samples. Sampling types that have bias (convenience sampling, voluntary response sample). Reducing bias (Simple Random Samples, SRS), using table A. Reducing variability (large samples).
- Chapter 4: **Other problems of sample surveys.** Undercoverage, nonresponse, bad wording
- Chapter 5-6: **Experiments.** A subject, a response variable, an explanatory variable, a treatment, lurking variables, confounded variables, statistical significance
- Chapter 5-6: **Experimental design.** Randomized experiments, control (placebo). Number of treatments, total number of subjects. Double-blind experiment, matched pairs design, block design.
- Chapter 10: **Graphical representation of data.** Pie-charts, bar graphs, line graphs. Reading and building each type of graphs, transferring information between different types of graphs.

Practice problems

1.



- Is this graph a bar graph, a line graph or a pie chart?
- Does this describe a distribution of a quantitative or a categorical variable?
- Roughly, what percent of sold passenger cars was produced by General Motors?
- Roughly, what percent of sold passenger cars was produced by Ford and Chrysler, combined?
- A discovered missing piece of data states that the remaining 8.2% of cars were produced by other companies. Include this data in the graph
- Which one of the following graphs shows the same data as above:



2. In order to assess the opinion of students at the U on campus safety, a reporter interviews 15 students he meets walking on the campus late at night who are willing to give their opinion.

- Is this an experiment or an observational study?
- What is the population that the reporter is trying to study?

- c) What is the sample?
- d) Do you think this is a good way to obtain the data for this study? Why or why not?

3. A sociologist wants to know the opinions of local employed adult women about government funding for daycare. She mails a questionnaire to 100 of local working women selected at random. Only 41 questionnaires are returned.

- a) What is the population in this study?
- b) What is the sample from which information is actually obtained?

4. A university office collects data on GPAs of students in their senior year. They pick at random 4 students from the university database and record their GPAs. Here is what they get: 2.8, 3.2, 2.4, 3.8. They conclude in their report that “75% of all seniors have GPAs below 3.5”.

- a) What is the population in this study?
- b) What is the sample?
- c) What is the variable that is being measured?
- d) What is the parameter that the study aims to estimate? What is the value of the corresponding statistic?
- e) Should the University Senate trust the results of this study? Why or why not?

5. According to the U.S. Department of Energy, the average American home spends energy on four main areas as shown in the following table:

Lights and Appliances	Heating and cooling	Water Heating	Cold storage
33%	44%	14%	9%

- a) Can one use a Pie Chart to visualize the above data? Why or why not? Plot a Pie Chart, if your answer is yes. Make sure your graph is as clear as possible.
- b) Can one use a Bar Graph to visualize the above data? Why or why not? Plot a Bar Graph, if your answer is yes. Make sure your graph is as clear as possible.

6. Answer true or false to each of the following statements:

- a) A survey asking “Ever cheated on a test?” creates a biased sample.
- b) A Census is never biased.
- c) A sample of students picked at random is definitely biased, since there is a chance that

all of them happen to be males.

d) In a double-blind experiment a doctor prescribes the treatment to each patient, but the patients don't know what treatment they receive and they have to cover their eyes during treatment

7. New varieties of corn with altered amino acid content may have higher nutritional value than standard corn. An experiment compares a new variety with normal corn. The researchers mix three different diets with each type of corn: 12% protein diet, 16% protein, and 20% protein. They feed each diet to 10 one-day-old male chicks and record their weight gain after 21 days. The weight gain of the chicks is a measure of the nutritional value of their diet.

a) What are the subjects and the response variables in this experiment?

b) How many explanatory variables are there?

c) How many treatments are there? Use a table to describe what the treatments are.

d) How many subjects does the experiment require?