Business Statistics: A First Course, 2nd Cdn. Ed. **(Sharpe)**
Part 1   Exploring and Collecting Data

Part 1 Chapter 1: Statistics, Data, and Decisions

1   Quiz A

1) The mission of a Canadian research firm is to "explore the impact of the Internet on families, communities, work, home, and daily life." In August - September 2013 the researchers in the firm conducted telephone interviews with a sample of Canadian adults aged 18 and older about online shopping. Describe the W's for the information given.
• Who:
• What:
• When:
• Where:
• How:
• Why:
Answer: Who: American adults aged 18 and older
What: Online shopping
When: August - September 2007
Where: United States
How: Telephone interviews
Why: To explore the impact of the internet on daily life, specifically shopping
Type: ES
Objective: 1

2) What is Statistics?
Answer: Statistics is a way of reasoning, along with a collection of tools and methods, designed to help us understand the world.
Type: SA
Objective: 1

3) What are Data?
Answer: Data are values along with their context
Type: SA
Objective: 1

4) The following data table displays some of the data collected by a Canadian research firm about online shopping. List the variables in the data set and indicate whether each variable is categorical or quantitative. If the variable is quantitative, give its unit of measurement.

Age	Gender	Household Income	Participated in online auction?	Monthly amount spent online	Time (hours) per week browsing online retailers
25	Male	$55 000	Yes	$250	6
47	Female	$60 000	No	$50	4
38	Female	$110 000	No	$120	10
30	Male	$62 000	No	$75	4

Answer: Categorical: Gender, Participated in online auction?
Quantitative: Age (years), Household income ($), Monthly online spending ($), Browsing time per week (hours).
Type: ES
Objective: 1

5) In addition to the variables listed above, data were also collected on the following variables. Indicate whether each variable is nominal or ordinal.
• *Region* (Urban, Suburban, Rural)
• *Education* (Less than High School, High School, College, and College +)
• *Marital Status* (Single, Widowed, Divorced, Married)
Answer: Region: Nominal
Education: Ordinal
Marital Status: Nominal
Type: ES
Objective: 1

6) For each of the following data, indicate whether the data are cross-sectional or time series:
• *Weekly receipts at a clothing boutique*
• *Monthly demand for an automotive part*
• *Percentage of adults who bank online*
Answer: Weekly receipts at a clothing boutique: Time series
Monthly demand for an automotive part: Time series
Percentage of adults who bank online: Cross-sectional
Type: ES
Objective: 3

2 Quiz B

1) The Therapeutic Products Directorate (TPD) of Health Canada is responsible for assessing the safety, efficacy and quality of a drug entering the Canadian market (http://www.hc-sc.gc.ca/). TPD routinely compares drugs in terms of effectiveness and safety. In summer 2010, TPD scientists reviewed drugs used to treat arthritis. Information was reported on convenience of use (how many pills required each day), possible side effects (e.g., dizziness, stomach upset), cost, and ratings of effectiveness in relieving symptoms (very effective, somewhat effective, not effective). Describe the W's for the information given.
• Who:
• What:
• When:
• Where:
• How:
• Why:
Answer: Who: Drugs to treat arthritis currently on the market
What: Convenience of use, side effects, cost, effectiveness ratings
When: Summer 2008
Where: Not specified, probably United States
How: Testing on drugs
Why: Information for potential consumers/patients
Type: ES
Objective: 1

2) The Therapeutic Products Directorate (TPD) of Health Canada is responsible to assess the safety, efficacy and quality of a drug to enter Canadian market (http://www.hc-sc.gc.ca/). *TPD* routinely compares drugs in terms of effectiveness and safety. In summer 2010, TPD scientists reviewed drugs used to treat arthritis. Information was reported on convenience of use (how many pills required each day), possible side effects (e.g., dizziness, stomach upset), cost, and ratings of effectiveness in relieving symptoms (very effective, somewhat effective, not effective). List the variables reported in assessing the safety and efficacy of drugs used to treat arthritis. If the variable is quantitative, give its unit of measurement. If the variable is categorical, indicate whether it is nominal or ordinal.
Answer: Categorical: Side effect (nominal), effectiveness rating (ordinal)
Quantitative: Convenience of use (number of pills), Cost ($)
Type: ES
Objective: 1

3) The Human Resources Department of a large Canadian corporation maintains records on its employees. The table below displays some of these data. List the variables in the data set. Indicate whether each variable is categorical or quantitative. If the variable is quantitative, give its unit of measurement. If the variable is categorical, indicate whether it is nominal or ordinal.

Age	Employment Category	Education	Participates in Wellness Program?	Monthly amount spent online
32	Clerical	High School	Yes	$250
52	Professional	College	No	$120
60	Professional	Junior College	Yes	$0
28	Clerical	High School	No	$120

Answer: Categorical: Employment Category (nominal), Education (ordinal), Participation in Wellness Program? (nominal)
Quantitative: Age (years), Paycheck Benefit Deductions ($)
Type: ES
Objective: 1

4) For each of the following, indicate whether the data are cross-sectional or time series:
• *Company quarterly profits*
• *Percentage of American adults who work full time*
• *Historical closing stock prices*
Answer: Company quarterly profits: Time series
Percentage of American adults who work full time: Cross-sectional
Historical closing stock prices: Time series
Type: ES
Objective: 3

5) What is an experiment?
Answer: A study in which the researcher *manipulates* factor levels to assess the effect of the factor on the response.
Type: SA
Objective: 4

6) What are cross-sectional data?
Answer: Data taken from situations that vary over time but measured at a single time instant are said to be a cross-section of the time series.
Type: SA
Objective: 3

3 Quiz C - Multiple Choice

1) In the fall of 2013, a Canadian research firm conducted telephone interviews with a sample of Canadian adults aged 18 and older about online shopping. Canadian adults aged 18 and older constitute the _____ of the study.
A) Who
B) What
C) When
D) Where
E) How
Answer: A
Type: MC
Objective: 1

2) A few of the variables for which data were collected in a *Canadian Research Project* include age, gender, income, number of computers in the household, and number of hours spent shopping online per month. Which of the variables is categorical?
A) Age
B) Gender
C) Income
D) Number of hours spent shopping online
E) Number of computers in the household
Answer: B
Type: MC
Objective: 1

3) The *Internet & Life Project* study also asked respondents to indicate their education level on the following scale: *Less than High School, High School, Some College, College, University.* Which of the following statements is (are) true?
A) Education level is a time series variable.
B) Education level is nominal scaled.
C) Education level is a quantitative variable.
D) Education level is a categorical variable.
E) Education level is both a time series variable and nominal scaled.
Answer: D
Type: MC
Objective: 1

4) In a telephone interview of a sample of Canadians, the researchers asked respondents to indicate their education level on the following scale: *Less than High School, High School, Some College, College +.* Which of the following statements is (are) true?

I.   Education level is a categorical variable.
II. Education level is nominal scaled.
III. Education level is ordinal scaled.

A) I only
B) II only
C) III only
D) I and II
E) I and III
Answer: E
Type: MC
Objective: 1

5) The Therapeutic Products Directorate (TPD) of Health Canada is responsible for assessing the safety, efficacy and quality of a drug to enter the Canadian market (http://www.hc-sc.gc.ca/). TPD routinely compares drugs in terms of effectiveness and safety. In summer 2010, TPD scientists reviewed drugs used to treat arthritis. Among the information reported was convenience of use (how many pills required each day) and possible side effects (e.g., dizziness, stomach upset). Convenience of use and possible side effects constitute the _____ of the study.
A) Who
B) What
C) When
D) Where
E) How
Answer: B
Type: MC
Objective: 1

6) What is the "Who" in the TPD study on the effectiveness and safety of drugs used to treat arthritis?
A) Drugs to treat arthritis currently on the market
B) Convenience of use and possible side effects
C) Summer 2008
D) The United States
E) Testing on drugs
Answer: A
Type: MC
Objective: 1

7) In the TPD study on arthritis drugs, possible side effects is what kind of variable?
A) Quantitative
B) Categorical
C) Nominal
D) Quantitative and Nominal
E) Categorical and Nominal
Answer: E
Type: MC
Objective: 1

8) The TPD study on arthritis drugs also took cost into consideration. Cost is
A) a nominal variable.
B) a categorical variable.
C) a quantitative variable.
D) an ordinal variable.
E) an irrelevant variable.
Answer: C
Type: MC
Objective: 1

9) The Human Resources Department of a large Canadian corporation maintains records on its employees. Data are maintained of the following variables: *Age, Employment Category, Education, Whether the employee participates in a wellness program*, and *Paycheck benefit deductions.* Which of these variables are categorical?
A) *Age, Employment Category*, and *Education*
B) *Employment Category, Education*, and *Whether the employee participates in a wellness program*
C) *Education, Whether the employee participates in a wellness program*, and *Paycheck benefit deductions*
D) *Employment Category and Age*
E) *Paycheck Benefit Deductions*
Answer: B
Type: MC
Objective: 1

10) Which of the following is (are) based on cross-sectional data?
A) Company quarterly profits
B) Percentage of American adults who work full time
C) Historical closing stock prices
D) Weekly consumption of gas in a city
E) Daily gas prices
Answer: B
Type: MC
Objective: 3

11) Which of the following is <u>not</u> time series data?
A) Weekly receipts at a clothing boutique
B) Monthly demand for an automotive part
C) Quarterly sales of automobiles
D) Percentage of American adults who work full time
E) Daily gas prices
Answer: D
Type: MC
Objective: 3

12) A company conducted a survey of its employees to determine their level of satisfaction with various company policies. The data collected from this survey are
A) primary data.
B) secondary data.
C) transactional data.
D) census data.
E) quantitative data.
Answer: A
Type: MC
Objective: 3, 4

13) Bell Canada tracks employee turnover annually. It currently has a data set that contains turnover for the past 20 years. What type of data does it have?
A) Cross-sectional data
B) Nominal data
C) Time series data
D) Ordinal data
E) Categorical data
Answer: C
Type: MC
Objective: 3

14) The human resources department at a major high tech company recently conducted an employee satisfaction survey of 100 of its 3000 employees. Data were collected on such variables as age, gender, marital status, current salary, level of overall satisfaction on a scale from 1 to 5, number of years with the company, and job title. Which of the following best describes the overall data set that was generated from the study?
A) Cross-sectional data
B) Time series data
C) Nominal data
D) Quantitative data
E) Categorical data
Answer: A
Type: MC
Objective: 3

15) The human resources department at Bell Canada recently conducted an employee satisfaction survey of 100 of its employees. Data were collected on such variables as age, gender, marital status, current salary, level of overall satisfaction on a scale from 1 to 5, number of years with the company, and job title. Which of the variables would be classified as nominal data?
A) Age and gender
B) Age
C) Age and number of years with the company
D) Gender, marital status, and job title
E) Level of overall satisfaction
Answer: D
Type: MC
Objective: 1

16) The human resources department at Bell Canada recently conducted an employee satisfaction survey of 100 of its employees. Data were collected on such variables as age, gender, marital status, current salary, level of overall satisfaction on a scale from 1 to 5, number of years with the company, and job title. Which of the variables would be considered to be quantitative data?
A) Gender and current salary
B) Age and gender
C) Age, number of years with the company, and current salary
D) Marital status and current salary
E) Level of overall satisfaction on a scale from 1 to 5, number of years with the company, and job title
Answer: C
Type: MC
Objective: 1

17) Tim Hortons conducts a random survey of 1000 customers in their Ottawa outlets on a particular day. For each customer they collect data on the time taken to fill the order, how frequently the customer comes to Tim Hortons in a week, whether the customer purchased only coffee or additional item(s), and the level of overall satisfaction using a scale from 1 to 5. What is the "Who" of this study?
A) The time taken to fill the customer order
B) Whether the customer purchased only coffee or additional item(s)
C) The level of overall satisfaction
D) How frequently the customer comes to Tim Hortons in a week
E) The 1000 randomly chosen customers
Answer: E
Type: MC
Objective: 1

18) A Canadian business school is concerned with the recent drop in female students in its BBA program. It decides to collect data from the admission office on each applicant, including sex of each applicant, age of each applicant, whether or not they were accepted, whether or not they attended, and the reason for not attending (if they did not attend). The school hopes to find commonalities among the female accepted students who have decided not to attend the BBA program. The process for collecting data answers which of the following questions?
A) How
B) Who
C) What
D) When
E) Where
Answer: A
Type: MC
Objective: 1

19) Tim Hortons conducts a random survey of 1000 customers in their Ottawa outlets on a particular day. For each customer they collect data on the time taken to fill the order, how frequently the customer comes to Tim Hortons in a week, whether the customer purchased only coffee or additional item(s), and the level of overall satisfaction using a scale from 1 to 5. The random survey answers which of these questions?
A) How
B) Who
C) What
D) When
E) Where
Answer: A
Type: MC
Objective: 1

20) Tim Hortons conducts a random survey of 1000 customers in their Ottawa outlets on a particular day. For each customer they collect data on the time taken to fill the order, how frequently the customer comes to Tim Hortons in a week, whether the customer purchased only coffee or additional item(s), and the level of overall satisfaction using a scale from 1 to 5. Which of the variables is quantitative?
A) Whether the customer purchased only coffee or additional item(s)
B) The time taken to fill the order, and how frequently the customer comes to Tim Hortons in a week
C) The level of overall satisfaction
D) Whether the customer purchased only coffee or additional item(s) and the level of overall satisfaction
E) The level of overall satisfaction and how frequently the customer comes to Tim Hortons in a week
Answer: B
Type: MC
Objective: 1

21) When a survey uses responses such as *strongly disagree, disagree, neutral, agree, strongly agree*, what type of data are collected?
A) Ordinal data
B) Nominal data
C) Cross-sectional data
D) Time series data
E) Quantitative data
Answer: A
Type: MC
Objective: 1

22) Which of the following is a secondary data source?
A) Conducting a telephone survey
B) Conducting personal interviews
C) Conducting a mail out written survey
D) Using Statistics Canada data
E) Conducting an experiment
Answer: D
Type: MC
Objective: 3, 4

Part 1 Chapter 2: Displaying and Describing Categorical Data

1   Quiz A

A large national retailer of electronics conducted a survey to determine consumer preferences for various brands of digital cameras. The table summarizes responses by brand and gender.

	Female	Male	Total
Sony Cyber-Shot	73	59	132
Kodak – Easy Share	49	47	96
Canon Power Shot	58	33	91
Pentax	37	41	78
Olympus	45	28	73
Other Brands	86	67	153
Total	348	275	623

1) Identify the variables and tell whether each is categorical or quantitative.
Answer: Gender and Brand; both categorical.
Type: ES
Objective: 1, 2

2) Find each of the following percentages.
a.   What percent of the responses were males who prefer Pentax?
b.   What percent of the male responses prefer Pentax?
c.   What percent of the consumers who choose Pentax were males?
Answer:
a.   6.6% (41/623)
b.   14.9% (41/275)
c.   52.6% (41/78)
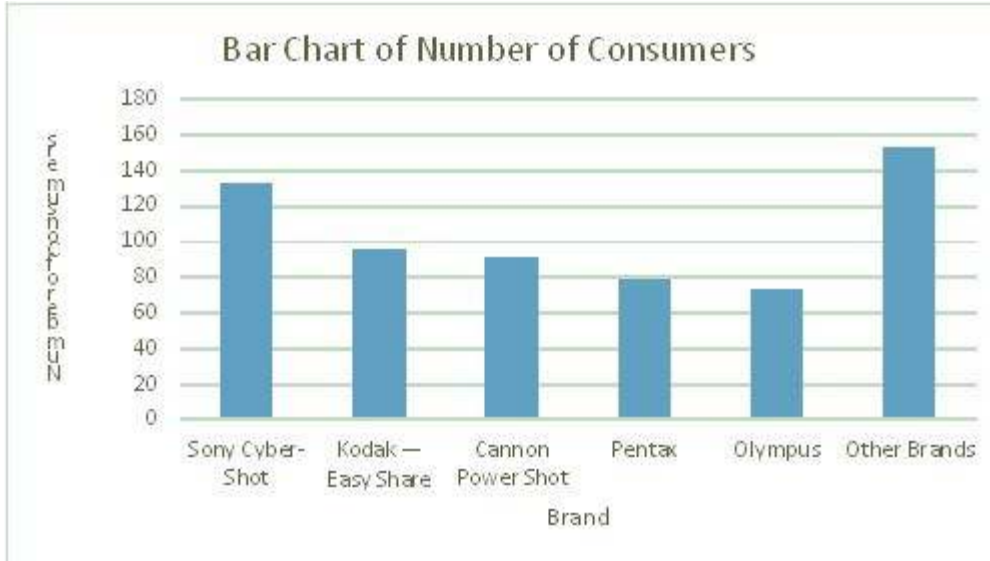Type: ES
Objective: 2

3) What is the marginal distribution of brands?
Answer: 132 for Sony Cyber-Shot, 96 for Kodak-Easy Share, 91 for Canon Power Shot, 78 for Pentax, 73 for Olympus and 153 for other brands.
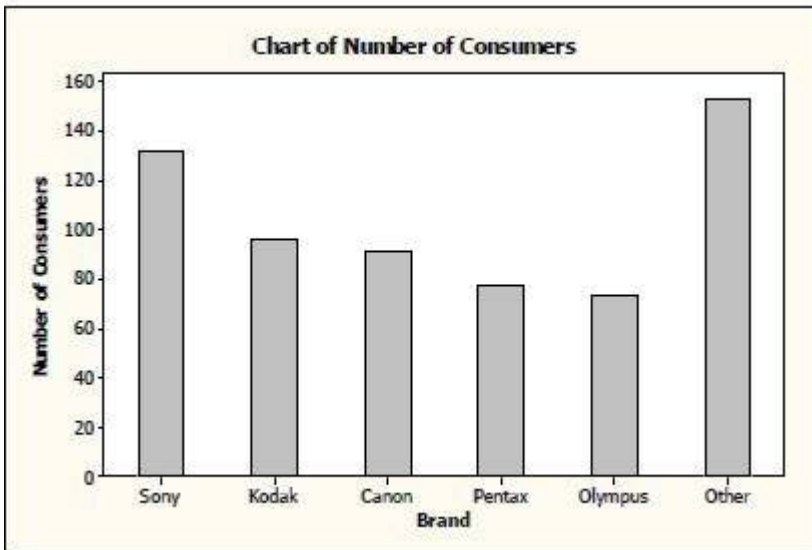Type: ES
Objective: 3, 4

4) Prepare an appropriate chart to display the marginal distribution of brands.

Answer: Either a bar chart (shown below) or a pie chart is appropriate.

Type: ES
Objective: 1

5) Define area principle.
Answer: A principle that helps to interpret statistical information without distortion by insisting that in a statistical display each data value be represented by the same amount of area.
Type: ES
Objective: 1

6) What is Mosaic Plot?
Answer: A graphical representation of a (usually two-way) contingency table. The plot is divided into rectangles so that the area of each rectangle is proportional to the number of cases in the data set.
Type: ES
Objective: 1

A large national retailer of electronics conducted a survey to determine consumer preferences for various brands of digital cameras. The table summarizes responses by brand and gender.

	Female	Male	Total
Sony Cyber-Shot	73	59	132
Kodak – Easy Share	49	47	96
Canon Power Shot	58	33	91
Pentax	37	41	78
Olympus	45	28	73
Other Brands	86	67	153
Total	348	275	623

7) Write a sentence or two about the conditional relative frequency distribution of the brands among female respondents.
Answer: Among females, 21% prefer Sony, 14.1% prefer Kodak, 16.7% prefer Canon, 10.6% prefer Pentax, and 12.9 % prefer Olympus. The remaining 24.7% of females preferred other brands.
Type: ES
Objective: 3

8) Consider the following side-by-side bar chart for these data:
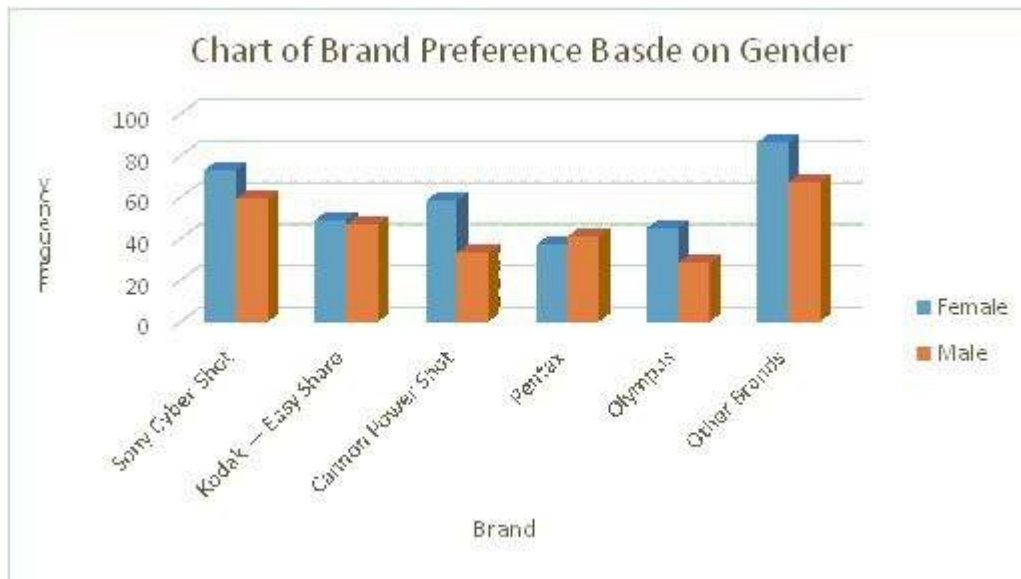
Does the chart indicate that brand preference is independent of gender? Explain.
Answer: Brand preference does not appear to be independent of gender. Brand preferences seem to differ based on gender.
Type: ES
Objective: 1, 2

2 Quiz B

A full service brokerage firm gathered information on how its clients were investing for retirement. Based on age, clients were categorized according to where the largest percentage of their retirement portfolio was invested. The following table summarized the data.

	Age 50 or Younger	Over Age 50	Total
Mutual Funds	30	34	64
Stocks	37	45	82
Bonds	19	23	42
Total	86	102	188

1) Identify the variables and tell whether each is categorical or quantitative.
Answer: Type of investment and age; type of investment is categorical; age is quantitative.
Type: ES
Objective: 1, 2

2) Find each of the following percentages.

a.   What percent of the clients are over the age of 50 and invest in mutual funds?
b.   What percent of clients over age 50 invest in mutual funds?
c.   What percent of the mutual fund investors are over age 50?
Answer:
a.   18.1% (34/188)
b.   33.3% (34/102)
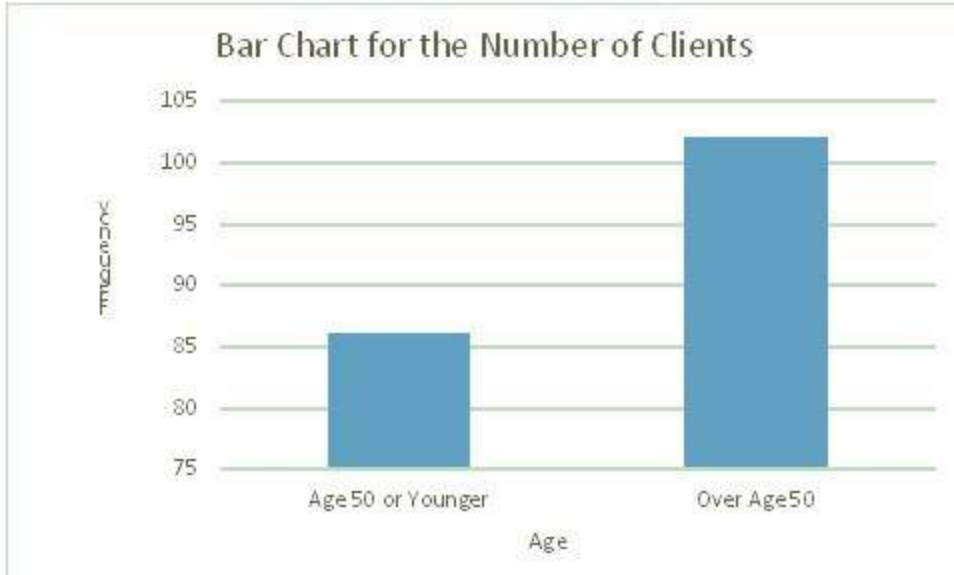c.   3.1% (34/64)
Type: ES
Objective: 2

3) What is the marginal distribution of age?
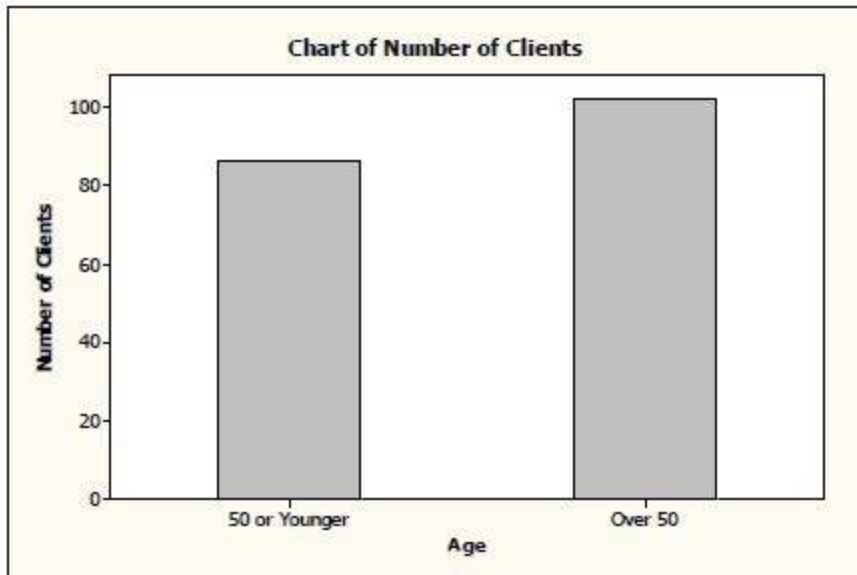Answer: 86 clients are age 50 or younger and 102 are over age 50.
Type: ES
Objective: 3, 4

4) Prepare an appropriate chart to display the marginal distribution of age.

Answer: Either a bar chart (shown below) or a pie chart is appropriate.


Type: ES
Objective: 1

5) Write a sentence or two about the conditional relative frequency distribution of mode of investment for clients age 50 or younger.
Answer: More clients age 50 or younger invested their retirement savings primarily in stocks rather than in any other mode of investment; 35% invested in mutual funds while only 22% invested in bonds.
Type: ES
Objective: 3

6) Consider the following side by side bar chart for these data:

Investment Preference Based on Age
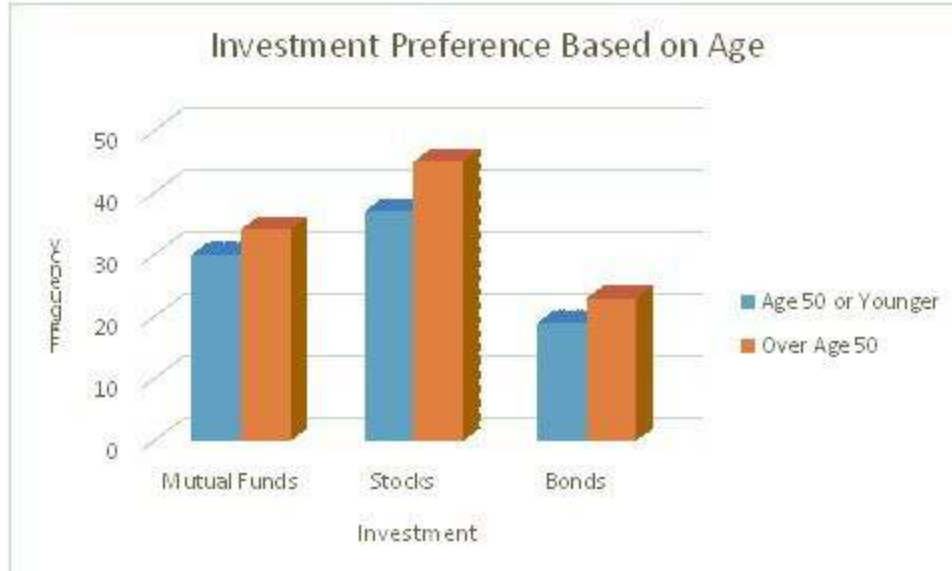
Does the chart indicate that mode of investment is independent of age? Explain.
Answer: The way clients invest for retirement does seem to be independent of age. These data provide little indication of a difference in mode of investing for retirement based on clients' ages at this firm.
Type: ES
Objective: 1

7) What is contingency table?
Answer: A contingency table displays counts and, sometimes, percentages of individuals falling into named categories on two or more variables. The table categorizes the individuals on all variables at once, to reveal possible patterns in one variable that may be contingent on the category of the other.
Type: SA
Objective: 2

8) What is marginal distribution?
Answer: In a contingency table, the frequency distribution of either variable alone. The counts or percentages are the totals found in the margins (usually the right-most column or bottom row) of the table.
Type: SA
Objective: 3, 4

3   Quiz C - Multiple Choice

A large national retailer of electronics conducted a survey to determine consumer preferences for various brands of digital cameras. The table summarizes responses by brand and gender.

	Female	Male	Total
Sony Cyber-Shot	73	59	132
Kodak – Easy Share	49	47	96
Canon Power Shot	58	33	91
Pentax	37	41	78
Olympus	45	28	73
Other Brands	86	67	153
Total	348	275	623

1) The percentage of consumers who are male and prefer Pentax is
A) 44.1% (275/623).
B) 6.6% (41/623).
C) 52.6% (41/78).
D) 14.9% (41/275).
E) 12.5% (78/623).
Answer: B
Type: MC
Objective: 2

2) Of the consumers who are male, the percentage who prefer Pentax is
A) 44.1% (275/623).
B) 6.6% (41/623).
C) 52.6% (41/78).
D) 14.9% (41/275).
E) 12.5% (78/623).
Answer: D
Type: MC
Objective: 2

3) Of the consumers who prefer Pentax, what percentage is male?
A) 61.6% (45/73)
B) 6.6% (41/623)
C) 52.6% (41/78)
D) 14.9% (41/275)
E) 12.5% (78/623)
Answer: C
Type: MC
Objective: 2

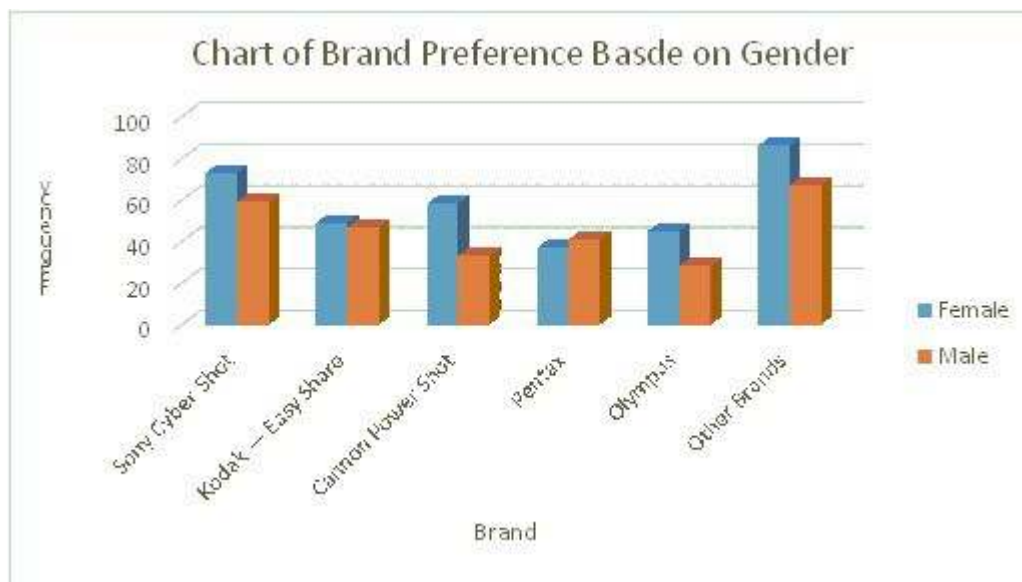4) Of the consumers who are female, the percentage who prefer Olympus is
A) 61.6% (45/73).
B) 6.6% (41/623).
C) 12.9% (45/348).
D) 16.4% (45/275).
E) 12.5% (78/623).
Answer: C
Type: MC
Objective: 2

5) Here is the side-by-side bar chart for these data.

Which of the following statements is (are) true?
A) It appears that camera preference and gender are related.
B) It appears that camera preference and gender are not independent.
C) It appears that camera preference and gender are independent.
D) More males than females prefer Canon.
E) More females than males prefer Pentax.
Answer: B
Type: MC
Objective: 1, 4

6) The following bar chart for these data shows
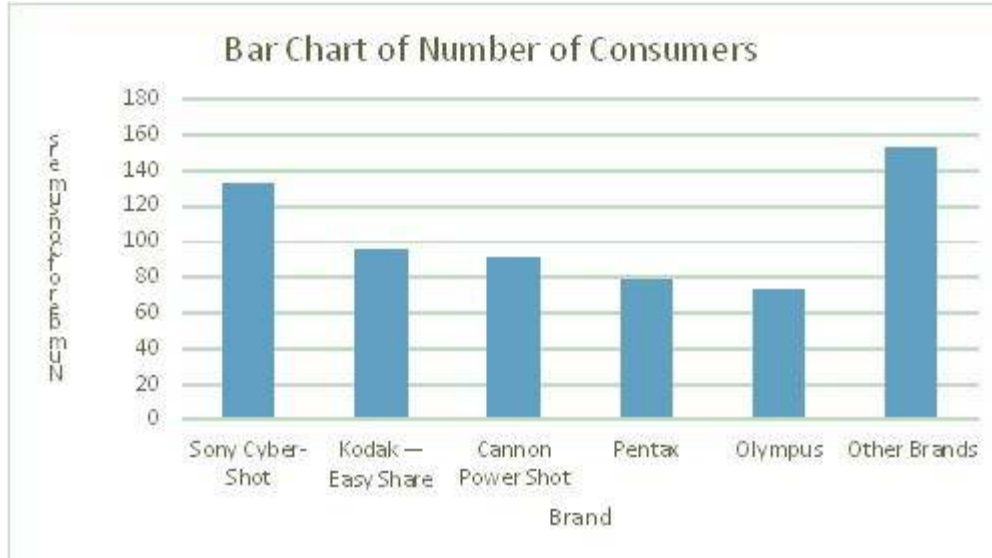
A) the marginal distribution of brands.
B) the conditional distribution of brands.
C) the marginal distribution of gender.
D) the conditional distribution of gender.
E) the relative frequency of brands.
Answer: A
Type: MC
Objective: 3, 4

A full service brokerage firm gathered information on how its clients were investing for retirement. Based on age, clients were categorized according to where the largest percentage of their retirement portfolio was invested. The following table summarized the data.

	Age 50 or Younger	Over Age 50	Total
Mutual Funds	30	34	64
Stocks	37	45	82
Bonds	19	23	42
Total	86	102	188

7) The percentage of clients who are over age 50 and invest in mutual funds is
A) 53.1% (34/64).
B) 33.3% (34/102).
C) 18.1% (34/188).
D) 34% (64/188).
E) 54.3% (102/188).
Answer: C
Type: MC
Objective: 2

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