**SOLUTIONS TO PROBLEMS IN**

**CHAPTER 1: INTRODUCTION TO STATISTICS**

1.1 Examples of data in business disciplines:

accounting – revenue/sales, cost of goods, salary expense, depreciation, utility costs, taxes, equipment inventory, etc.

finance - World bank bond rates, number of failed savings and loans companies, measured risk of common stocks, stock dividends, foreign exchange rate, liquidity rates for a single-family, etc.

human resources - salaries, size of engineering staff, years experience, age of employees, years of education, etc.

 marketing - number of units sold, dollar sales volume, forecast sales, size of sales force, market share, measurement of consumer motivation, measurement of consumer frustration, measurement of brand preference, attitude measurement, measurement of consumer risk, etc.

 operations and supply chain management - the number, location, and network missions of suppliers, production facilities, distribution centers, warehouses, cross-docks, and customers; the quantity and location of inventory, including raw materials, work in process (WIP), and finished goods, etc.

information systems - CPU time, size of memory, number of work stations, storage capacity, percent of professionals who are connected to a computer network, dollar assets of company computing, number of “hits” on the Internet, time spent on the Internet per day, percentage of people who use the Internet, retail dollars spent in e-commerce, etc.

production - number of production runs per day, weight of a product; assembly time, number of defects per run, temperature in the plant, amount of inventory, turnaround time, etc.

management - measurement of union participation, measurement of employer support, measurement of tendency to control, number of subordinates reporting to a manager, measurement of leadership style, etc.

1.2 Examples of data that can be gathered for decision-making purposes in

 business industries:

manufacturing - size of punched hole, number of rejects, amount of inventory, amount of production, number of production workers, etc.

insurance - number of claims per month, average amount of life insurance per family head, life expectancy, cost of repairs for major auto collision, average medical costs incurred for a single female over 45 years of age, etc.

travel - cost of airfare, number of miles traveled for ground transported vacations, number of nights away from home, size of traveling party, amount spent per day on vacation besides lodging, etc.

retailing - inventory turnover ratio, sales volume, size of sales force, number of competitors within 2 miles of retail outlet, area of store, number of sales people, etc.

communications - cost per minute, number of phones per office, miles of cable per customer headquarters, minutes per day of long distance usage, number of operators, time between calls, etc.

computing - age of company hardware, cost of software, number of CAD/CAM stations, age of computer operators, measure to evaluate competing software packages, size of data base, etc.

agriculture - number of farms per county, farm income, number of acres of corn per farm, wholesale price of a gallon of milk, number of livestock, grain storage capacity, etc.

banking - size of deposit, number of failed banks, amount loaned to foreign banks, number of tellers per drive-in facility, average amount of withdrawal from automatic teller machine, federal reserve discount rate, etc.

healthcare - number of patients per physician per day, average cost of hospital stay, average daily census of hospital, time spent waiting to see a physician, patient satisfaction, number of blood tests done per week.

1.3 Descriptive statistics in recorded music industry :

 1) RCA total sales of compact discs this week, number of artists under contract to a company at a given time.

 2) total dollars spent on advertising last month to promote an album.

 3) number of units produced in a day.

 4) number of retail outlets selling the company's products.

Inferential statistics in recorded music industry :

 1) Measure the average amount spent per month on recorded music for a few consumers, then use that figure to infer the average amount for the population.

 2) Determination of market share for rap music by using the proportion of a randomly selected sample of 500 purchasers of recorded music who purchased rap music.

 3) Determination of top ten single records by sampling the number of requests at a few radio stations.

 4) Estimation of the average length of a single recording by using the average length of a sample of records.

The difference between descriptive and inferential statistics lies mainly in the usage of the data. These descriptive examples all gather data from every item in the population about which the description is being made. For example, RCA measures the sales on all its compact discs for a week and reports the total.

In each of the inferential statistics examples, a sample of the population is taken and the population value is estimated or inferred from the sample. For example, it may be practically impossible to determine the proportion of buyers who prefer rap music. However, a random sample of buyers can be contacted and interviewed for music preference. The results can be inferred to population market share.

1.4 Descriptive statistics in manufacturing batteries to make better decisions :

 1) total number of worker hours per plant per week - help management understand labor costs, work allocation, productivity, etc.

 2) company sales volume of batteries in a year - help management decide if the product is profitable, how much to advertise in coming year and compare to costs to determine profitability.

 3) total amount of sulfuric acid purchased per month for use in battery production. - can be used by management to study wasted inventory, scrap, etc.

 4) total amount of defective and/or rejected units produced per day/week/month. - can be used by management to study wasted resources, need for labor training, redesign of assembly process, etc.

Inferential Statistics in manufacturing batteries to make decisions :

 1) Take a sample of batteries and test them to determine the average shelf life - use the sample average to reach conclusions about all batteries of this type. Management can then make labeling and advertising claims. They can compare these figures to the shelf- life of competing batteries.

 2) Take a sample of battery consumers and determine how many batteries they purchase per year. Infer to the entire population - management can use this information to estimate market potential and penetration.

 3) Interview a random sample of production workers to determine attitude towards company management - management can use this survey results to ascertain employee morale and to direct efforts towards creating a more positive working environment which, hopefully, results in greater productivity.

 1.5 1) Size of sale ($) per customer in men’s formal wear. Either by taking a sample or using a census, management could compute the average sale in men’s formal wear of a weekly period and compare the number to the same average taken a year ago or a month ago to determine if more is being purchased per customer. Other variables might include number of sales per hour, number of people entering the department per day, number of dress shirts sold per day, etc.

 2) Number of employees working per day. This variable could indicate the day of the week (certain days have more or less sales), sales activity (how sales are doing overall), or even health of associates. Other variables might include percent of employees absent due to illness, average number of hours worked per week per employee, number of open positions, etc.

 3) Inventory turnover rate. How fast are items in the store selling? Other variables might include reorder rate, percent of storage space utilized, number of stockouts per week, etc.

 4) Number of customers that enter the store per hour. This figure will vary by day, time of day, and season. Comparing figures on this variable from period to period can give some indication of sales trends which can help drive human resource planning, etc. Other variables might include amount of time spent per customer in the store per visit, distance that customers travel to shop in the store, number of referrals that customers make to other people annually, etc.

 5) Percentage of people paying with cash. Percentage of people using credit cards. These can be used to expedite pay systems, investigate employee theft, calculate surcharges associated with credit cards, etc. Other variables might include average time per checkout, average wait time in pay line, etc.

 1.6 1) Size of bill or tab. This variable is the total amount in dollars spent by a patron per visit to the restaurant. The bill or tab could be for an individual or a group and would include both food and beverages if they are all included in the bill. Of course, the measurement would be in dollars. This information could be very useful for the manager or owner to know the average size of a bill both in projecting out total revenues over a period or as a baseline before a marketing effort to increase sales.

 2) Percentage of Capacity Filled. This variable could be measured at various intervals, times, and days of the week. The measurement would be calculated by taking the number of patrons in the restaurant at any one time divided by the total number of seats in the restaurant (capacity). From this, management could make staffing decisions for various times and days of the week. In addition, management could make decisions about when to expand, how much to advertise, and/or when to run specials.

 3) Length of Stay. The measurement is how many minutes people are actually in the restaurant from the time they are assigned a table until they are leaving. From this, management could determine customer turnover rates which have capacity implications. That is, how many times in a day is an average table “turned over”. If people stay longer, do they spend more?

 4) Number of Arrivals per 5-minute intervals. The measurement is how many customers arrive at the front door to be greeted by the maître‘d in any given five-minute period. This figure will likely vary by day of the week, season of the year, and time of day. Management can use this information for staffing decisions and planning.

1.7 a) ratio

 b) ratio

 c) ordinal

 d) nominal

 e) ordinal

 f) ratio

 g) nominal

 h) ratio

1.8 a) ordinal

 b) ratio

 c) nominal

 d) ratio

 e) ratio

 f) ratio

 g) nominal

 h) ordinal

 1.9 a) The population for this study is the 900 electric contractors who purchased Mapletech’s wire.

 b) The sample is the randomly chosen group of 35 contractors.

 c) The statistic is the average satisfaction score for the sample of thirty-five contractors.

 d) The parameter is the average satisfaction score for all 900 electric contractors in the population.

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