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REVIEW – CHAPTER 4

4.1 – STATISTICAL MEASURE

1. Calculate the **per capita** value for each situation

(a) Number of school buses in Canada in 2005-2006: **35000**; Number of students enrolled: **5200000**

(b) Volume of eggnog sold in December: **5900000 L**; Canada's population: **32900000**

(c) Area of agricultural land in Canada: **67 600 000 ha**; Canada's population: **32900000**

(d) Mass of spinach consumed: **8900000 kg**; Canada's population: **32900000**

2. Calculate the **percent change** for each situation

FORMULA: $Percent\,change = \frac{New\,value - Old\,value}{Old\,value} \times 100$

(a) Height increased from **1.60 m** to **1.66 m**

(b) Average speed changed from **89.4 km/h** to **38.5 km/h**

(c) Annual spending decreased from **$24556** to **$21292**

(d) The population increased from **223450** to **682903**

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3. The table on the right shows the scores on a high school math competition, ranked from lowest to highest

Score	Rank	Score	Rank
188	12	468	6
301	11	479	5
308	10	487	4
329	9	508	3
405	8	548	2
410	7	566	1

(a) Determine the **percentile rank** of each score using the formula

$$Percentile(p) = \left(\frac{L + 0.5E}{n} \right) \times 100$$

(i) 329

(ii) 548

(b) Which score is in each percentile? Use the formula **score position = p × n**

(i) 60th percentile

(ii) 25th percentile

4. To calculate the final mark on an English test, Ms. Lee weights the short answer section **30%** and the essay section **70%**. Determine the **final test mark** for each student. An example has been provided

STUDENT	***SHORT ANSWER (OUT OF 25)***	***30% OF SHORT ANSWER***	***ESSAY QUESTION (OUT OF 40)***	***70% OF ESSAY QUESTION***	***FINAL TEST MARK***
Caleb	16	16/25 × 30 = **19.2**	30	30/40 × 70 = **52.5**	19.2 + 52.5 = **71.7**
Sunita	21		38		
Danielle	19		20		
Jesse	24		34		
Gavin	20		32		

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5. The table below shows the number of births and population in three provinces in 2006-2007.

Complete the table below to determine the **birth rate** for each province. * **Birth rate** is a per capita population per 1000

PROVINCE	***NUMBER OF BIRTHS***	***POPULATION***	***BIRTH RATE (PER 1000 PEOPLE)***
Ontario	134141	12740721	
Alberta	44661	3430221	
British Columbia	42306	4348583	

6. The table on the right shows a company's profits each year for five years.

(a) Calculate the **percent change** in profit from **2004 to 2005**

Year	Profit ($)
2004	237 000
2005	395 000
2006	850 000
2007	1 002 000
2008	723 000

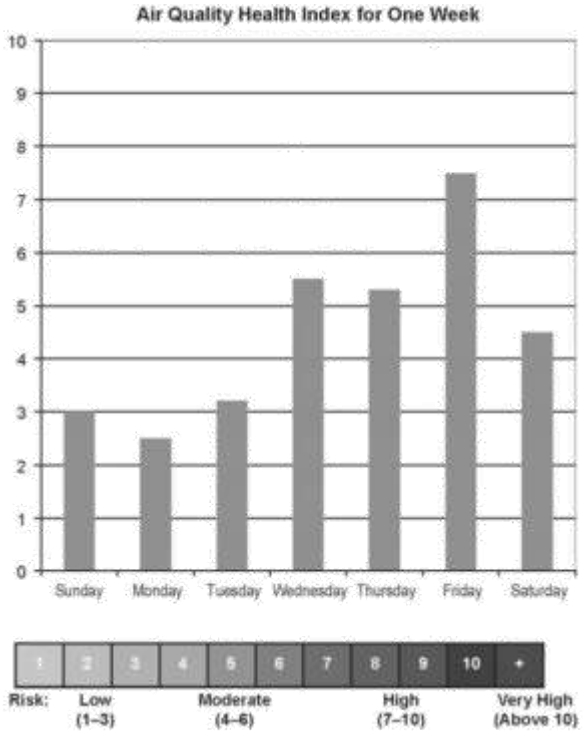
(b) Calculate the **percent change** in profit from **2007 to 2008**

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4.2 – STATISTICAL INDICES

1. The Air Quality Health Index (AQHI) measure the level of many air pollutants. It has a scale from 1 to 10, where 1 represents low health risk and 10 represents high health risk. The graph on the right shows the AQHI for Ottawa for one week.



(a) Estimate the value of the index for each day of the week. Classify the health risk for each day

Sunday:

Monday:

Tuesday:

Wednesday:

Thursday:

Friday:

Saturday:

(b) By what **factor** did the index increase between **Wednesday** and **Friday**?

FACTOR = NEW INDEX ÷ OLD INDEX

(c) Calculate the **percent decrease** from **Friday** to **Saturday**

$$Percent\ change = \frac{New\ value - Old\ value}{Old\ value} \times 100$$

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2. Each year, the Employment Insurance (EI) premium rates in Canada are adjusted based on the forecasted revenues and payments of the program for that year. The employee EI premium rate for 2004 to 2006 is show on the table on the right.

Year	Employee EI Premium Rate (%)
2004	1.98
2005	1.95
2006	1.87

(a) Calculate the **percent decrease** in the employee EI premium rate from **2004** to **2006**

(b) The yearly maximum employee EI premium in 2004 was **$772.20**. Calculate the yearly maximum employee EI premium in 2006.

3. On January 2, 2004, Raquel invested **$2000** in a fund that mirrors the Toronto Stock Exchange Index (TSX). She recorded the value of the TSX on that day as **8293.70**

Calculate the value of Raquel's investment on January 2, 2008 when the TSX was **13833.06**. * Hint: Calculate the **factor first**

4. The UV Index is a measure of the intensity of the sun's ultraviolet (UV) radiation. The greater the UV Index, the greater the potential harm to your skin, eyes and immune system.

UV Index	Category
11+	extreme
8 to 10	very high
6 to 7	high
3 to 5	moderate
0 to 2	low

(a) The UV Index for London, Ontario measure **3.5** on Wednesday but increased to **6.1** on Thursday. Calculate the **percent increase** of the index

(b) One day, the UV Index measured **7.2** in Toronto and **3.4** in Ottawa. By what **factor** was Ottawa's measure less than the measure in Toronto?

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5. On December 4, 2005, Francis invested **$1500** in a find that mirrors the Toronto Stock Exchange Index (TSX). He recorded the value of the TSX on that day as **11005.24**

(a) Calculate the value of Francis' investment on September 4, 2008 when the TSX was **12814.14**

(b) Francis decided to keep his money invested. Calculate the value of Francis' investment on December 4, 2008 when the TSX was **8057.52**

4.3 – INTERPRET STATISTICS IN THE MEDIA

1. Write **three questions** that could be used to challenge or validate each claim

(a) 7 out of 10 home decorating subscribers rank Homedeco Guru as their favourite magazine

(b) Buttonlatch bags can increase freezer storage life of food by three months

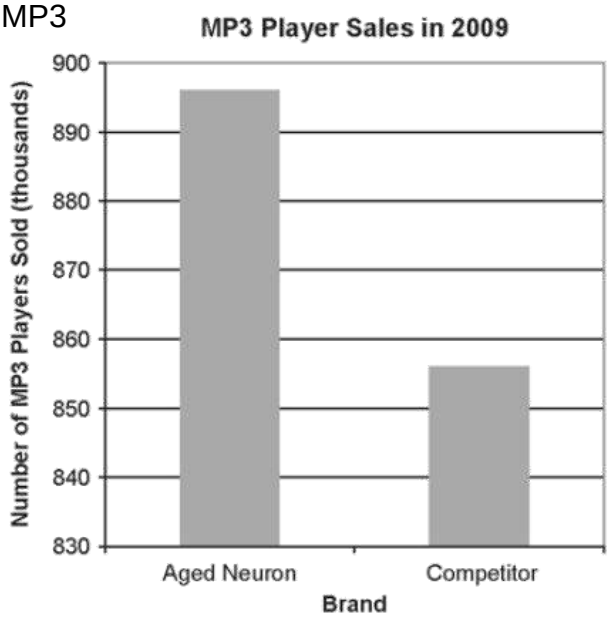
(c) A recent test confirmed that Insectiprotect pesticide is 30% better for the environment

(d) Tests show that Ballena is one of the safest cars in its class, so it is a great choice for a safety-conscious individual

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2. In a magazine advertisement, Aged Neuron brand MP3 (music) players presents the graph on the right of MP3 player sales in 2009.



(a) What is the advertiser's main message in this advertisement?

(b) Describe how the graph distorts the data

(c) Describe how the graph could be changed to better illustrate the data

3. A magazine article included the statement: "66.4% of Canadians are happy with their job. The results are accurate to within 3.2 percentage points, 19 times out of 20". Explain the meaning of this statement.

4. Below are two advertisement offers. Explain which advertisement offers more savings.

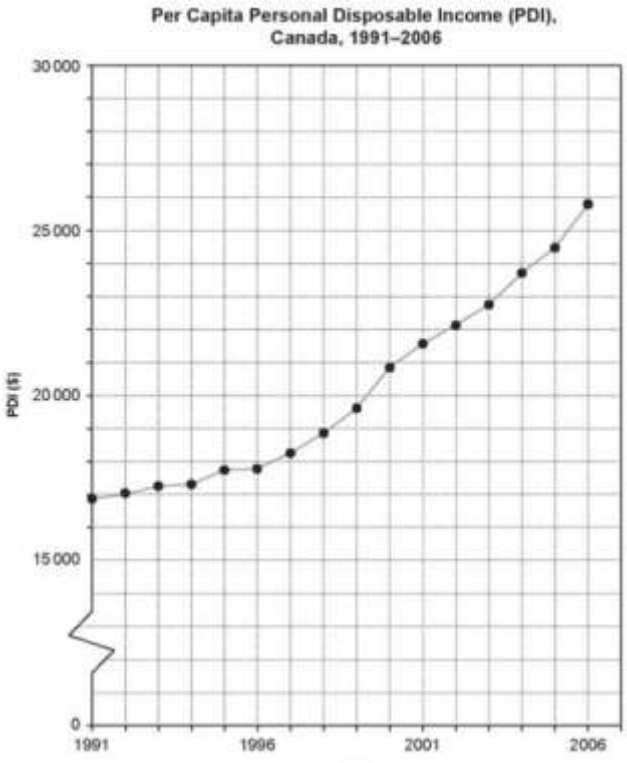
Advertisement A
Take $20 off the regular price of $100.
Buy before Friday to take 40% off the sale price.

Advertisement B
Take 40% off the regular price of $100.
Use your coupon to take an additional $20 off the sale price.

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5. A newspaper article included the graph on the right, which shows Canada's per capita personal disposable income (PDI) from 1991 to 2006. PDI is the sum of all incomes of residents of Canada, minus personal direct taxes.



(a) What is meant by **"per capita PDI"**?

(b) Use the graph to determine the **per capita DPI** for each year

(i) 1991 = _____ (ii) 1996 = _____
(iii) 2001 = _____ (iv) 2006 = _____

(c) Using the values from (b), calculate the **percent growth** in per capita DPI for each 5-year period

1991 to 1996:

1996 to 2001:

2001 to 2006:

4.4 – STATISTICAL BIAS

1. A TV commercial urges viewers to complete a survey on how they feel about technology. The survey is located on the company's website. What type(s) of bias does this represent? Explain

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2. Suggest changes to each experiment so it does not contain measurement bias

(a) Students took turns standing still in the middle of a room while another student measure their height with a metre stick

(b) To measure the time for an ice cube to melt at room temperature, a student places one on his desk and closely observes it from his chair, using a stopwatch to record the time

3. “The current Prime Minister has an approval rating of 62%. Do you approve or disapprove of the recent actions the current Prime Minister has taken?” Rewrite this survey question so it does not contain response bias

4. Identify the bias for each scenario

SCENARIO	***BIAS***
(a) Participants in a study were asked: “Is your financial situation this year as good as last year or better than last year?”	
(b) The volume of water in three beakers was recorded. The recorded volumes were less than the actual volumes because the person doing the study did not measure the volume of water at eye level	
(c) To study her peers’ opinions about the important of exercise, Ivana surveyed only the members of her school’s jogging club	
(d) A student handed out a survey that asked “Do you enjoy watching professional hockey?” Response rates were significantly higher for males than females	

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5. Which situations contain **sampling bias**? How can the bias be corrected?

(a) Commuters at various bus stops around the city are asked to complete a survey on their opinions of public transit

(b) A national survey was conducted. 200000 surveys were mailed to homes randomly selected from each province and territory, in proportion to the population of each province or territory

7. Which of the statements below is a better way of asking the question. Explain.

A "Do you believe that the rate of deforestation in Canada is acceptable or unacceptable at the present time, or are you undecided?"

B "In Canada, approximately 56 000 ha of forest are deforested every year. Do you believe that more should be done to protect Canada's forests?"

4.5 – CRITICAL ANALYSIS

1. Identify each example as **descriptive** or **inferential** statistics. Explain your choice

	DESCRIPTIVE or INFERENTIAL	***EXPLANATION***
(a) A toy company's customer service department received 564 phone calls in one month, 42 of which were about defective products		
(b) A national survey was sent to 10000 randomly selected homes in Canada. The results of the survey indicate that 37.5% of Canadians use the Internet to file their personal income tax		

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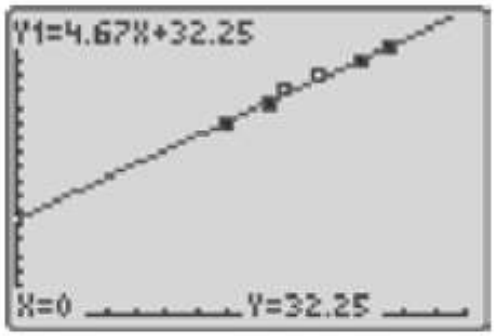
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1. (continued)

	DESCRIPTIVE or INFERENTIAL	***EXPLANATION***
(c) Based on a random sample of 1000 students interviewed at Ontario high schools, 82% of high school students spend at least 1 hour per night on homework		
(d) Every student at a community college was surveyed. It was found that 83% of students enjoy their program of study		

2. Mr. Singh surveyed six of his students on the average number of hours spend on homework per week. He recorded this information along with each student's midterm exam mark (chart on left). Mr. Singh then graphed the data and used linear regression to find the equation of the line of best fit to be M = 4.67T + 32.25 (graph on the right)

Time Spent on Homework, *T* (h/week)	**Midterm Exam Mark, *M* (out of 100)**
7.0	65
8.5	71
10.0	80
9.0	75
12.5	91
11.5	85



Is it reasonable for Mr. Singh to conclude that if all students spent an average of 14.5 hours on homework per week, they would all obtain a midterm mark of 100? Explain by performing critical analysis on this conclusion

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3. For each study, which source of statistics would you consider to be **less** biased? Or are they **both** biased? Explain

(a) The Joint Canadian Tanning Association or Health Canada on the safety of indoor tanning

(b) Statistics Canada or a television news program on the overall state of the economy

(c) The Ontario Teachers Federation or a high school student on the importance of education

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SOLUTION

4.1

1. (a) 0.007 buses (b) 0.179 L (c) 2.055 ha
   (d) 0.271 kg

2. (a) 3.75% increase (b) 56.94% decrease (c) 13.29% decrease
   (d) 205.62% increase

3. (a) (i) 29% (ii) 88%
   (b) (i) 479 (ii) 318.5

4. Caleb: 71.7%, Sunita: 91.7%, Danielle: 57.8%, Jesse: 88.3%, Gavin: 80.0%

5. Ontario: 10.5, Alberta: 13.0, British Columbia: 9.7

6. (a) 66.67% (b) -27.8%

4.2

1. (a) Sunday: 3.0, low; Monday: 2.5, low; Tuesday: 3.2, low;
   Wednesday: 5.5, moderate; Thursday: 5.3, moderate; Friday: 7.5, high
   Saturday: 4.5, moderate
   (b) 1.36
   (c) 40%

2. (a) 5.556% (b) $729.30

3. $3335.80

4. (a) 74.3% (b) 0.47

5. (a) $1746.55 (b) $1098.23

4.3

1. Answers may vary

2. (a) Aged Neuron sells more than the competitor
   (b) y-axis scale not suitable to make a comparison between both brands

3. If poll was conducted 20 times, results would fall between 3.2 percentage points (between 63.2% and 69.6%). This would happen in 19 out of 20 polls

4. B, percent discount applied would result in a savings of $60

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5. (a) PDI divided by the population of Canada
   (b) (i) $16900 (ii) $17800 (iii) $21600
   (iv) $25800
   (c) 1991 to 1996: 5.33%, 1996 to 2001: 21.35%, 2001 to 2006: 19.44%

4.4

1. Sampling bias and non-response bias, TV watchers and Internet uses only people that can answer survey. Of those, some may not want to answer

2. (a) Use a measuring tool longer than a metre stick
   (b) Use more ice cubes

3. Answers may vary

4. (a) Response bias; need option to see if their finances were worse
   (b) Measurement bias; human error
   (c) Sampling bias; only students that exercised were surveyed
   (d) Non-response bias; not everyone may watch hockey

5. (a) Sampling bias; not all commuters take the bus as other options are available
   (b) No sampling bias

6. B, uses a statistic to generate emotion response

4.5

1. (a) Descriptive, data is described without making conclusions about a larger population
   (b) Inferential, data is being treated as a sample and is used to draw a conclusion about a larger population
   (c) Inferential, data is being treated as a sample and is used to draw a conclusion about a larger population
   (d) Descriptive, data is being summarized without making conclusions about a larger population

2. No, sample size is too small and many factors may affect the marks

3. (a) Health Canada is less biased
   (b) Statistics Canada is less biased
   (c) Both are biased

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