

**Exam Review: Ch. 1-3
Answer Section**

MDM 4U0

MULTIPLE CHOICE

- | | | |
|------------|-------------|------------|
| 1. ANS: A | Section 1.6 | |
| 2. ANS: A | Section 1.6 | |
| 3. ANS: A | Section 1.7 | |
| 4. ANS: A | Section 1.7 | |
| 5. ANS: C | Section 2.3 | |
| 6. ANS: B | Section 2.3 | |
| 7. ANS: D | Section 2.5 | LOC: S2.01 |
| 8. ANS: A | Section 2.6 | |
| 9. ANS: D | Section 3.1 | |
| 10. ANS: C | Section 3.1 | |
| 11. ANS: A | Section 3.2 | |
| 12. ANS: C | Section 3.3 | |
| 13. ANS: B | Section 3.3 | |

COMPLETION

- | | | | |
|----------|------------|-------------|---------------------------------|
| 14. ANS: | discrete | Section 2.1 | LOC: S1.04 TOP: Organizing data |
| 15. ANS: | continuous | Section 2.1 | LOC: S1.04 TOP: Organizing data |

SHORT ANSWER

16. ANS:
a) connected
b) not complete
c) traceable since two vertices have odd degree and all the others have even degree

REF: Applications OBJ: Section 1.5 LOC: OD2.03 TOP: Graph theory

17. ANS:

$$X^t = \begin{bmatrix} 7 & 4 \\ 0 & 2 \\ -1 & 3 \end{bmatrix}$$

REF: Knowledge & Understanding OBJ: Section 1.6 LOC: OD3.02
TOP: Matrix transpose

18. ANS:

$$\begin{bmatrix} 18 & -11 & -3 \\ 9 & 2 & 4 \end{bmatrix}$$

REF: Knowledge & Understanding OBJ: Section 1.6 LOC: OD3.02
TOP: Matrix operations

19. ANS:

a)
$$\begin{bmatrix} -25 & 15 \\ 0 & 15 \\ 5 & 15 \end{bmatrix}$$

b)
$$\begin{bmatrix} -1 & -4 & -26 \\ 9 & -15 & 4 \\ -16 & 2 & -17 \end{bmatrix}$$

20. ANS:

- a) systematic sample
- b) simple random sample
- c) cluster sample
- d) stratified sample

21. ANS:

- a) current and potential readers of the sports section
- b) sampling bias

22. ANS:

loaded questions

- a) Which is less damaging to the environment: nuclear power or hydro-electric power?
- b) Can fast food be nutritious?

23. ANS:

- a) mean 44.1, median 49, mode 53
- b) The mean indicates that the arithmetic average of the group's ages is about 44. The median indicates that half of the friends are under 49 and the other half are over 49. The mode indicates that 53 is the most common age in the group, but this information is not significant since the group is so small.
- c) Since the median is higher than the mean, the group's ages must be unevenly distributed.

24. ANS:

Since the study is trying to determine the characteristics of the population of all autistic children, use the formulas for calculating statistics for a sample.

$$\bar{x} = 45.7, s = 15.1, s^2 = 229$$

25. ANS:

No, the sample with only three left-handed students is far too small to use as a basis for any conclusions. A sample this small could be significantly skewed by statistical fluctuation, an outlier, or extraneous variables. Also, marks on a mathematics test measure students' skills at writing mathematics tests, which is not necessarily the same as their ability to understand mathematical logic.

PROBLEM

26. ANS:

The network of roads is traceable since two vertices have odd degree and all the others have even degree.

27. ANS:

$$2x_{11} + 3 = 9, \text{ so } x_{11} = 3$$

$$2x_{12} - 2 = 2, \text{ so } x_{12} = 2$$

$$2x_{21} + 1 = 3, \text{ so } x_{21} = 1$$

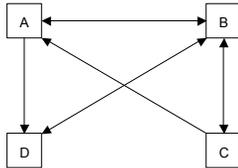
$$2x_{22} + 4 = -2, \text{ so } x_{22} = -3$$

$$\text{Therefore, } X = \begin{bmatrix} 3 & 2 \\ 1 & -3 \end{bmatrix}.$$

REF: Applications OBJ: Section 1.6 LOC: OD3.02 TOP: Matrix operations

28. ANS:

a) Answers will vary. One method is to use arrows to indicate the direction of communication, as shown below.



b) From the network diagram above, it can be seen that the route with exactly one intermediate computer is D to B to A. This result can be verified by determining the value of entry n_{41} in N^2 :

$$N^2 = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 3 & 0 & 1 \\ 1 & 1 & 1 & 2 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

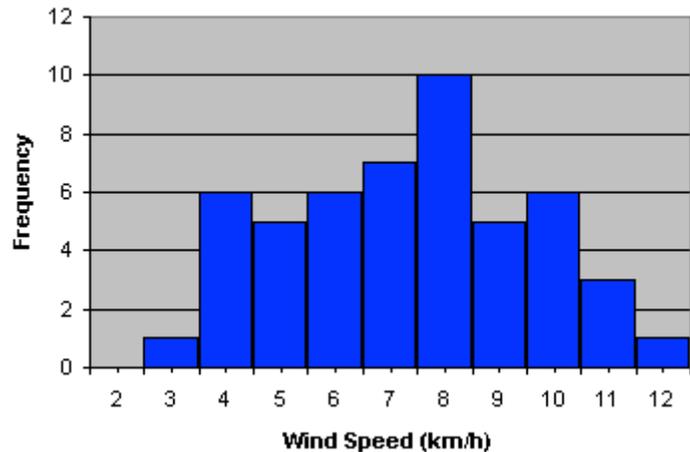
Since $n_{41} = 1$, there is only one route from D to A with exactly one relay.

$$\text{c) } N^3 = \begin{bmatrix} 2 & 3 & 1 & 2 \\ 3 & 2 & 3 & 4 \\ 2 & 4 & 1 & 2 \\ 1 & 3 & 0 & 1 \end{bmatrix}$$

Since N^3 has n_{43} equal to 0, office D cannot reach office C using exactly two intermediary computers.

29. ANS:

Wind Speed (km/h)	Frequency
3	1
4	6
5	5
6	6
7	7
8	10
9	5
10	6
11	3
12	1



30. ANS:

Answers may vary. Students should outline a method for randomly selecting 36 students from grade 9, 33 from grade 10, 31 from grade 11, and either 28 or 29 from grade 12.

31. ANS:

Sampling bias: Users of the department store's credit cards may not be representative of the general public.

32. ANS:

$$\begin{aligned}
 \text{a) } \mu &= \frac{\sum f_i m_i}{\sum f_i} \\
 &= \frac{7(2) + 12(5) + 5(8) + 3(11) + 2(14)}{7 + 12 + 5 + 3 + 2} \\
 &= 6.03
 \end{aligned}$$

Students in this course missed an average of about six classes each.

b) The total number of students is $7 + 12 + 5 + 3 + 2 = 29$, so the median interval is the one that includes the 15th largest value. Thus, the interval for 4–6 classes missed is the median interval.

33. ANS:

a) Since there are 21 cities listed, the median is simply the 11th highest value in the set of data: 193 600. The first quartile is the midpoint between the fifth and sixth lowest values, so $Q_1 = 97\,500$. Similarly, the third quartile is the midpoint between the fifth and sixth highest values, so $Q_3 = 350\,900$.

The median and quartiles can be calculated with a graphing calculator by entering the data into a list and then using the 1-Var Stats function from the STAT CALC menu. In a spreadsheet, you can use the MEDIAN and QUARTILE functions.

b) The range is the highest value minus the lowest one: $2\,571\,700 - 60\,300 = 2\,511\,400$. The interquartile range is $Q_3 - Q_1 = 253\,400$.

c) The 21 cities can be considered a sample of all the cities in Canada. Therefore, use the sample version of the formulas for the mean, standard deviation, and variance. On a graphing calculator, the 1-VAR Stats function will calculate both \bar{x} and s . In Microsoft® Excel, you can use the AVERAGE, STDEV, and VAR functions to calculate \bar{x} , s , and s^2 , respectively. In Corel® Quattro® Pro, use @AVG, @STDS, and @VARS. The resulting values are $\bar{x} = 381\,114$, $s = 552\,863$, and $s^2 = 2.6335 \times 10^{10}$.

	A	B	C	D	E
1	City	Population	Sorted		
2	Calgary	864700	60300	range	2511400
3	Edmonton	693800	71200	IQR	253400
4	Halifax	117200	72500	mean	381114.2857
5	Hamilton	347500	73600	median	193600
6	Kingston	60300	76600	Q1	97500
7	Kitchener	276400	97500	Q3	350900
8	Lethbridge	71200	99200	STDEV	552863.071
9	London	350900	117200	variance	2633512500
10	Ottawa	348500	122500		

d) For Windsor,

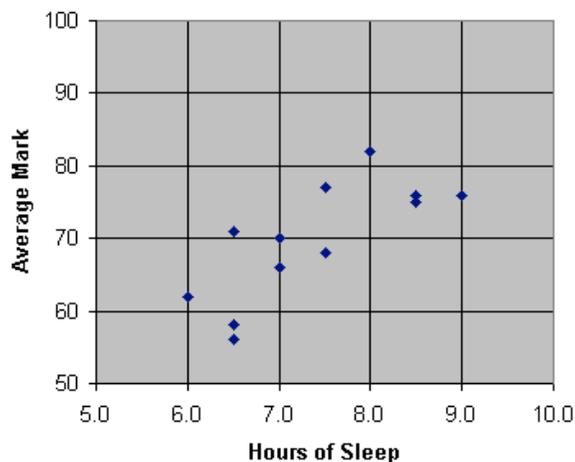
$$z = \frac{213\,100 - 381\,114}{552\,863} = -0.304$$

e) For Toronto,

$$z = \frac{2\,571\,700 - 381\,114}{552\,863} = 3.962$$

34. ANS:

a) The amount of sleep is the independent variable, so it is shown on the x-axis.



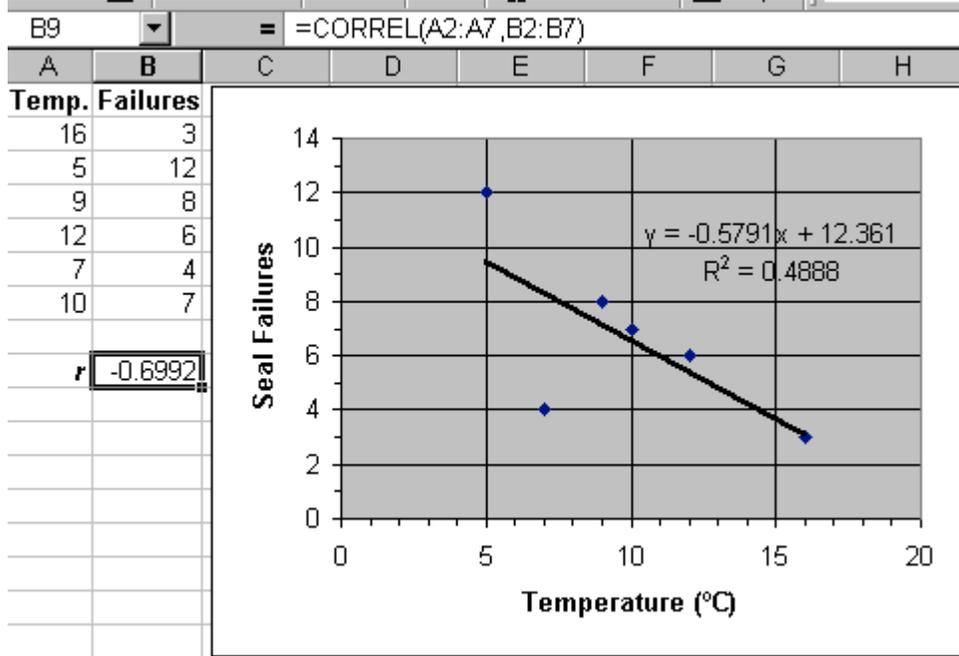
b) The correlation coefficient can be calculated using the formula below, the **linreg(ax+b)** instruction on a graphing calculator, or the **CORREL** function in a spreadsheet.

$$r = \frac{n \sum (xy) - (\sum x)(\sum y)}{\sqrt{\left[n \sum x^2 - (\sum x)^2 \right] \left[n \sum y^2 - (\sum y)^2 \right]}} = 0.76$$

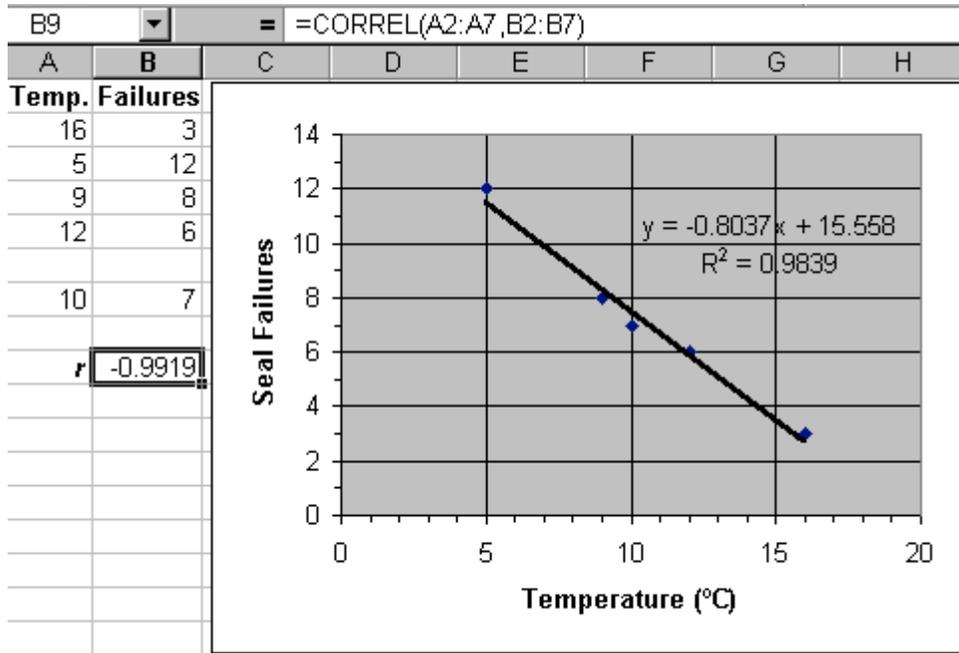
c) There is a strong positive correlation between amounts of sleep and average marks for these students. However, this correlation does not prove that getting more sleep causes higher marks.

35. ANS:

a)



- b) The point (7, 4) could be an outlier. On the scatter plot, this point is somewhat distant from the rest of the data.
- c) The linear regression can be done with a graphing calculator, a spreadsheet, or Fathom™. As shown in the spreadsheet screen above, the equation for the line of best fit is $y = -0.58x + 12.36$ and $r = -0.669$.
- d) Without the outlier, the equation for the line of best fit becomes $y = -0.80x + 15.56$ with $r = -0.992$.



- e) The outlier had a substantial effect on both the line of best fit and the correlation coefficient. Without the outlier, the data have a nearly perfect negative linear correlation.
- f) The sample size is very small.