

Problems For You To Do: (Sections 5.3 – 5.4)

- Clearly identify the conditions (requirements) for a *binomial experiment*.
 - In a binomial experiment how is a *binomial random variable* defined?
- Evaluate
 - $7!$
 - $\frac{10!}{7!3!}$
 - $\frac{100!}{(100-2)!2!}$
- In 8 flips of a fair coin, what is the probability that you get
 - exactly 4 heads and 4 tails?
 - at least 6 heads?
- For each of the following
 - indicate whether or not the variable is a binomial random variable
 - if it is *not* a binomial clearly indicate why not
 - the sum of 2 faces when you roll 2 dice.
 - the number of times that you get double sixes when you roll a pair of dice 20 times.
 - the number of times you cough per day when you have a cold.
- If the percentages quoted in the Sun article are correct, what is the probability that in a random sample of 10 Vancouverites
 - 4 of the 10 thought that the penalties should be beefed up for those that grow pot?
 - none of the 10 thought the penalties are too severe?
- A certain medication claims to alleviate pain in 60% of all migraine headache sufferers.
 - If the claim is true, what are the mean and standard deviation of the number of headache sufferers who experience pain relief with this medication in a random sample of 200 migraine patients?
 - If only 110 of the 200 experience pain relief, would you have strong evidence to doubt the 60% claim? Briefly explain.
- The local high-school basketball star sinks 60% of his free shots. If he takes 6 free shots in the championship game, what are the probabilities of the following events?
 - He will sink none of them.
 - No more than 2 will go in.
 - At least half will not go in.What assumption(s), not explicitly stated in the problem, did you have to make to calculate these probabilities?

FRIDAY, OCTOBER 15, 1999

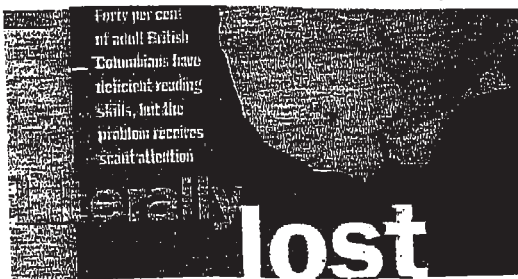
TORI CULBERT
VANCOUVER SUN

Vancouver residents have mixed views about the possession and use of marijuana, but many believe those who grow cannabis should face harsher penalties, says a poll conducted for *The Vancouver Sun*.

However, 42 per cent thought penalties should be beefed up for those who grow pot, while 17 per cent said they are too severe and 20 per cent said they are fine.

8. In an Extra Sensory Perception (ESP) experiment a computer randomly generates a whole number between 1 and 10 (inclusive) and a subject then tries to identify the generated number. If the subject is just guessing (without special ESP powers), what is the probability that she correctly identifies
- exactly 1 number in 10* independent trials of this experiment?
 - more than 3 numbers in 15* independent trials of this experiment?
 - at most 120 numbers in 1000* independent trials of this experiment?
9. Past weather data indicates that the probability of rain for a day in January in Vancouver is 0.75. Can the probability that it rains on exactly 4 days in a particular week in January in Vancouver be calculated as a binomial probability? Explain.

10.



A recent study indicates that forty percent of B.C. adults have deficient reading skills.

- What is the probability that in a random sample of 15 B.C. adults
 - exactly 4* have deficient reading skill
 - at least 4* have deficient reading skills.
 - no more than 10* have deficient reading skills.
- As part of the study, several random samples of 50 B.C. adults were taken.
 - What would you expect the number of people with deficient reading skills in each sample to be?
 - What is the standard deviation of the number of people with deficient reading skills in random samples of 50 adults?

11. The same literacy study revealed that only one-third of Canadians are aware of the problem. What is the probability that in a random sample of 10 Canadians, 4 are aware of the problem?

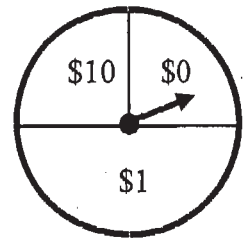
Although public awareness of literacy has grown steadily during the last 10 years, barely more than **one-third** of Canadians recognize the extent of the problem.

12. *Maclean's* conducted a marketing solutions poll of mutual funds and fund owners. One question asked fund owners what action they took after the October 1997 market drop. Seventeen percent of respondents said they bought more funds.
- Find the mean and standard deviation of the number of respondents who bought more funds, if groups of 900 fund owners were polled.
 - In one of these polls of 900 fund owners, 140 respondents bought more mutual funds. Is this unusual? Justify your answer!

13. 60 percent of the Lower Mainland population of 1.8 million list English as their first language. In a random sample of 50 people the probability of getting exactly 35 that have English as their first language is calculated as a binomial probability. Using the usual binomial notation, determine the values of x , n , p , and q .

14. Identify each variable described as Binomial (B), or Not Binomial (N):

- a) the number of spins of the pointer until a \$10 comes up.
- b) the number of times a \$10 comes up in 5 spins.
- c) the "amount won" on a single spin of the pointer.
- d) the total amount won on 5 spins of the pointer.
- e) the number of times a \$0 comes up before the first \$10 comes up.



15. A recent survey showed that only one of 10 public television viewers actually support public T.V. with a donation.

- a) During a public T.V. fund raising telethon, 14 public T.V. viewers are phoned randomly. What is the probability that:
 - i) exactly 2 of them support public T.V. with a donation?
 - ii) at most 1 of them supports public T.V. with a donation?
- b) What is the probability that out of the first 100 public T.V. viewers contacted, exactly 4 support public T.V. with a donation?

Annual Donation Reminder
In support of KJCTV

Dear Friend of KJCTV:
 A surprising fact has been brought to our attention. A recent survey revealed that only one out of 10 viewers who watch public television actually support public television with a donation. The reason for this is the misconception that when someone subscribes to cable or satellite, they are paying for public television.

16. On an 8 question True/False quiz you guess at each problem randomly. What is the probability that you get

- a) 3 right and 5 wrong?
- b) at most 2 right?

17. Assume that 2% of the ticks in the Lower Mainland are carriers of Lyme disease and that these carriers are distributed randomly across the large tick population. If you got 20 tick bites (from 20 different ticks) what is the probability that at least one of these bites came from a tick that was a carrier of Lyme disease?

March 3, 2000 UNDERCURRENT

Ticks spell trouble

"It's tick season," confirms Dr. Muhammad Morshed, a tick specialist at the BC Centre for Disease Control in Vancouver.

There is one confirmed case of the disease on Bowen, according to Bert Engelmann, the Environmental Control Officer for North Shore Health. However, Engelmann and Dr. Morshed say an estimated one to three percent of ticks in the lower mainland are carriers of Lyme disease.

"If you're getting one to two tick bites a month, it's not a big worry", he says. But if the bites are more regular you should be stepping up your precautions."

18. For each of the following determine whether or not the variable described is a *binomial* random variable, and, *if not*, briefly describe why not.
- The number of people in a sample of 200 Vancouver TV viewers who can recall a brand name after watching a TV commercial.
 - The number of times the number 7 comes up in 50 spins of a roulette wheel.
 - The number of heads when tossing a biased coin 100 times.
 - The total of the faces showing when a fair die is rolled 10 times.
19. Fifteen percent of 1,800,00 voters in BC favour the NDP. In a random sample of 50 BC voters, finding the probability of getting exactly 8 people who favour the NDP is the calculation of a particular probability of binomial random variable. Using the usual binomial notation, determine the values of x , n , p , and q .
20. If 10% of the population is left handed, what is the probability of more than two people being left handed in a random sample of 20 people?
21. Suppose the distribution of blood types for Vancouverites is

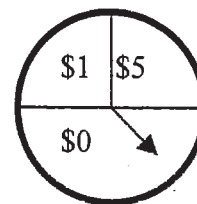
Blood Type	A	B	O	AB
Percentage	37%	13%	44%	6%

What is the probability that in a random sample of 5 Vancouverites

- all will have Blood Type O?
- none will have Blood Type AB?

22. a) If the pointer is fair, what are the mean and standard deviation of the number of \$5 outcomes in 48 spins?

b) If the pointer were spun 48 times and the \$5 came up only 4 times would you be suspicious about the fairness of the pointer? Justify your answer.



23. In Surrey, 26.5% of convicted marijuana growers receive jail sentences. What is the probability that out of the next 10 convicted marijuana growers in Surrey

a) exactly two will receive jail sentences?

b) at least two will receive jail sentences?

24. In the "Straight & Scramble" version of the BC Lottery Corporation Daily 3 game the probability distribution of your winnings for each \$1 played is given as

Winnings	\$290	\$40	\$0
Probability	$\frac{1}{1000}$	$\frac{1}{200}$	

a) What is the probability that you win \$0?

b) Suppose that you bought 1 ticket for each of the seven days in a week, what is the probability that *at least one* of your tickets wins a prize?

c) Suppose you bought 1 ticket for every day of the year (365). What is the expected number of tickets that will not win any money?

25. In a local college, 40% of the students entering will graduate. In a random sample of 10 students what are the probabilities of the following events to 4 decimal place accuracy?

- All will graduate.
- None will graduate.
- Exactly one will graduate.
- At least one will graduate.

Surrey marijuana growers more likely to face jail

Of 68 marijuana growers convicted in Surrey 26.5% received jail sentences, compared to 20.8 per cent of 72 convictions in Vancouver, a Sun survey finds.



DAILY 3 is a B.C.-only lottery featuring three ways to play—Straight, Scramble and Straight & Scramble. Playing DAILY 3 is as easy as 1, 2, 3!

PRICE:

- \$1, \$2, \$5 or \$10

DRAWS HELD:

- daily
- you can buy tickets up to 9 p.m. Pacific time for that day's draw

26. 18% of all people going in for laser eye surgery experience a complication.

THE VANCOUVER SUN, THURSDAY, FEBRUARY 18, 1999

- a) What is the probability that in 8 patients, chosen randomly,
 - i) exactly 2 will experience a complication?
 - ii) at least 1 will experience a complication?

- b) What are the mean and standard deviation of the number of complications in a group of 50 patients chosen randomly?

- c) Is there a cause for concern if a particular treatment centre had 15 out of 50 patients experiencing complications?
Briefly explain your answer and provide some technical justification.

Physicians' body warns of laser eye surgery risk

Vision can be impaired by bacteria in corneal refractive surgery, college says.

The complication hasn't been formally reported until now, but it has been discussed in medical circles for about five years. However, its incidence was thought to be rare and no one has been able to track its cause.

The college's warning, believed to be the first public advisory about the problem, is in response to an alert by Dr. Simon Holland, an ophthalmologist at The Laser Centre (TLC) in Vancouver.

Holland had observed a complication rate of 18 per cent (38 out of 210 patients) during a just completed four month study period at TLC.

27. A tele-marketing firm has determined that between 6:00 and 6:30 p.m., 40% of the telephones in the Vancouver area will be answered when the phone rings.
- a) If the company makes 12 calls at this time, what is the probability that at least 4 will be answered?
 - b) If you were to call people between 6:00 and 6:30 p.m. until you received an answer, what is the probability that you would have your first answered call on your third call?
 - c) If the company wishes to have 20 answered calls in this time period, how many total calls should they plan to make?
28. Assume that male and female births are equally likely and that the birth of any child does not affect the probability of the gender of any other children. In a family with 6 children what is the probability that there are
- a) exactly 3 girls and 3 boys?
 - b) at least one girl?
 - c) at most 2 boys?