Lab 6.

1. In Calgary, incompatibility is given as a legal reason for divorce in 70% of all divorce cases.
(a) What is the probability that in the next 6 divorce cases filed in Calgary, 5 will be due to incompatibility?
(b) If 5000 divorces occur each year in Calgary, what is the expected number of divorce cases due to incompatibility?

2. An automobile safety engineer figures that 1 in 10 automobile accidents are due to driver fatigue. What is the probability that at least 3 out of 5 accidents are due to driver fatigue?

3. Based on past experience, the probability that a student will pass this course is 0.7. From a random sample of 8 students,
(a) What is the probability that all 8 students pass this course?
(b) What is the probability that at least 2 students pass this course?
(c) In a class size of 107, how many students are expected to fail this course?

4. Find the following probabilities.
(a) $P(-0.72 \le Z \le 0)$
(b) $P(-0.35 \le Z \le 0.35)$
(c) $P(0.22 \le Z \le 1.87)$
(d) $P(Z \le -1.02)$
(e) $P(Z \ge -0.88)$
(f) $P(Z \ge 1.38)$
(g) $P(-0.34 \le Z \le 2.33)$

5. Given that Z is a standard normal random variable, determine Z_o if it is known that:

(a) $P(-Z_o \le Z \le Z_o) = 0.90$
(b) $P(-Z_o \le Z \le Z_o) = 0.10$
(c) $P(Z \ge Z_o) = 0.20$
(d) $P(-1.66 \le Z \le Z_o) = 0.25$
(e) $P(Z \le Z_o) = 0.40$
(f) $P(Z_o \le Z \le 1.80) = 0.20$

6. Every year around Halloween, many street signs are defaced. The average repair cost per sign is \$68.00 and the standard deviation is \$12.40.
   (a) What is the probability that a defaced sign's repair cost will exceed \$85.00?
   (b) If 5 signs are selected at random, find the probability that the mean cost exceeds \$85.00.

7. The time a recreational skier takes to go down a downhill course has a normal distribution with a mean of 12.3 minutes and a standard deviation of 0.4 minutes.

(a) What is the probability that the skier will take between 12.1 and 12.6 minutes to complete a run on the course?
(b) What is the maximum time (in minutes) the skier must have for the time to be classified "among the fastest 10% of his times"?
(c) If 4 skiers are selected at random, find the probability that their mean time is 12.8 minutes.

8. The time it takes Bob to get from home to his office follows a normal distribution. The probability that it takes him less than 3 minutes is 0.345. The probability that it takes him more than 10 minutes is 0.01. Find the average time and variance (μ and σ^2) of this normal distribution.

9. The captain of a Navy gunboat orders a volley of 26 missiles to be fired at random along a 500ft stretch of shoreline that he hopes to establish as a beachhead. Dug into the beach is a 30 foot-long bunker serving as the enemy's first line of defense. What is the probability that exactly
(a) 3 missiles will hit the bunker?
(b) Between 6 and 9 missiles, inclusive, will hit the bunker?
(c) If at least 10 successful missiles are needed to destroy the bunker, what is the probability that the captain is unsuccessful in destroying the bunker?
(d) What is the expected number of missiles to hit the bunker?

10. A newspaper advertisement claims that 55% of the people who wear contact lenses experience no difficulty. In a random sample of 300 people who have purchased contact lens,
(a) What's the probability of at least 150 people having no problems?
(b) What's the probability of having between 145 and 170 (inclusive) people having no problems?
(c) What's the probability of having less than 160 having no problems?

11. According to one study, 2/3 of all Canadians have at least 2 televisions. In a random sample of 1000 Canadians,

(a) What's the probability of exactly 668 Canadians having at least 2 televisions? (use approximation)
(b) What's the probability of between 640 and 670 (exclusively) Canadians having at least 2 televisions?
(c) What's the probability of greater than 670 Canadians having at least 2 televisions?

12. Estimate the probability of getting at least 52 girls in 100 births. Assume that boys and girls are equally likely.

13. Estimate the probability of passing a true/false test of 50 question if 60% (or 30 correct answers) is the minimum passing grade and all responses are random guesses.

14. Replacement times for TV sets are normally distributed with a mean of 8.2 years and

a standard deviation of 1.1 years.
(a) If 4 TV sets are selected at random, find the probability that all of them have replacement times less than 10 years.
(b) Find the approximate probability that in 250 randomly selected TV sets, at least 15 of them have replacement times greater than 10.0 years.

15. A manufacturer of automobile batteries claims that the distribution of the lengths of life of its best battery has a mean of 54 months and a standard deviation of 6 months.
    (a) If 10 batteries are selected at random, find the probability that exactly two of them have length of life less than 62 months.
    (b) Find the approximate probability that for 100 randomly selected batteries, at least 12 of them have life times greater than 62.0 months.

16. Electrical connectors last on average 18.2 months with a standard deviation of 1.7 months. Assume that the life of the connectors is normally distributed.
(a) The manufacturer agrees to replace, free of charge, any connectors that fail within 17 months of installation. What percentage of the connectors can he expect to have replaced free of charge?
(b) The manufacturer does not want to have to replace more than 2.5% of the connectors free of charge. What should he set the life at for free replacement?
(c) What is the probability that the **total** lifetime of 24 connectors will exceed 38 **years**?

17. The number of cars arriving at the service station just down the street from my place follows a Poisson distribution with a rate of 12 per hour. Find the probability that within the next hour
(a) at most 10 cars will arive.
(b) exactly 15 will arrive.
(c) At least 2 will arive.

18. A data processing company uses 200 personal computers. The probability that any one of them will break on a given day is 0.01. There are 3 spare computers availbable and broken machines are always fixed overnight. Using the Poisson distribution, find the probability that:
(a) on a given day, all computers will be used.
(b) On given day the number of spare computers is sufficient to replace all the broken ones.

19. A medical drop-in clinic receives, on average, 5 patients per hour. Find the probabilitiies of the following events:
(a) at least 2 patients will arive in a one hour period?
(b) 9 patients will arrive in 90 minute period?

20. Telephone calls come through an exchange at a rate of 2.6 call per 10 minute interval. What is the probability that
(a) exactly 2 calls in a **5 minute** interval?
(b) at least 2 calls in a 10 minute interval?

(c) no more than 1 call in a 1 minute interval?

21. The number of mistakes in one page of a solutions manual to a statistics textbook follows a Poisson distribution with a rate of 2.2 mistakes per page. Find the probability that a randomly chosen page contains at most 4 mistakes.