1. A jar contains five coins: a nickel (5¢), a dime (10¢), a quarter (25¢), a dollar ($1), and a toonie ($2). Two coins are randomly selected (without replacement) from the jar.

   (a) (3 points) What is the probability that the selection will contain the dollar?

   (b) (3 points) What is the probability that the total amount drawn will equal less than $2?

2. A department of 30 people (18 men and 12 women) is to select a committee of six people. How many different committees are possible if the committee is composed of

   (a) (3 points) Three men and three women?

   (b) (3 points) A president, vice-president, and four others?

3. A hospital administration did a survey of patients regarding satisfaction with care and type of surgery. The results follow:

	Heart	Hip	Knee	Total
Not Satisfied	7	12	2	21
Neutral	15	38	10	63
Satisfied	32	16	25	73
Very Satisfied	4	22	23	49
Total	58	88	60	206

   Find the probability that a randomly selected patient from this survey is

   (a) (2 points) A knee surgery patient.

   (b) (2 points) Satisfied, given had heart surgery.

   (c) (2 points) Very satisfied and had knee surgery.

   (d) (2 points) Are the events Satisfied and Had Heart Surgery independent? Justify your answer.

4. (6 points) Sam takes either his car or the subway to go to work with probabilities 0.45 and 0.55, respectively. When he takes his car, he is late 40% of the days. When he takes the subway, he is late 30% of the days. If Sam is late for work on a particular day, what is the probability that he took his car?

5. The probability distribution of your winnings at a casino's card game is shown below.

x	$0	$1	$2	$5
$p(x)$	0.1	0.4	0.2	0.3

   (a) (1 point) What is the chance you win more than $1 if you play just once?

   (b) (2 points) What are the expected winnings for this game?

   (c) (3 points) What is the standard deviation of winnings for this game?

6. (7 points) A machine produces parts of which 5% are defective. If a random sample of ten parts produced by this machine contains two or more defectives, the machine is shut down for repairs. Find the probability that the machine will not be shut down for repairs.

7. The distribution of the time that a battery pack for a laptop computer can function before requiring recharging is normal with a mean of 6 hours and standard deviation of 1.8 hours.

   (a) (5 points) Find the probability that a battery pack chosen at random will function at most 5.5 hours before recharging.

   (b) (5 points) A random sample of 25 laptops with this type of battery pack is selected and tested. What is the probability that the average time of the sample until recharging is at most 5.5 hours?

8. (10 points) One of the ways most Americans relieve stress is to reward themselves with sweets. According to one study in Food technology, 46% admit to overeating sweet foods when stressed. Use the normal distribution to approximate the probability that in a random sample of 100 Americans, more than half relieve stress by indulging in sweet foods.

9. (8 points) A random sample of 78 students were interviewed and 58 said they would vote for Alex Duvall as student body president. Let p represent the proportion of all students at this college who will vote for Alex. Find the 90% confidence interval for p.

10. Historically, the average time it takes Jessica to swim the 200-meter butterfly is 148.4 seconds. Jessica would like to know if her average time has changed, for the better or the worse. She records her time on 50 randomly selected occasions and computes the mean to be 147.8 seconds. Assume $\sigma = 2.3$ seconds. A hypothesis test will be carried out at the 0.05 level of significance.

   (a) (2 points) State the Null and Alternative hypotheses.

   (b) (3 points) Calculate the test statistic.

   (c) (3 points) Calculate (or estimate) the p-value for the test.

   (d) (3 points) State and interpret your conclusion.

11. In a small plant up north the hourly wages of male and female workers are known to be normally distributed. A sample of male workers and a sample of female workers were taken, giving the following summaries:

	Sample size	Hourly Wage Mean	Standard Deviation
Male	12	12.20	3.27
Female	13	8.11	3.53

   A hypothesis is to be tested at the 0.01 level of significance that female workers are paid on average less than the male workers.

   (a) (2 points) State the Null and Alternative hypotheses.

   (b) (3 points) Calculate the test statistic.

   (c) (3 points) Calculate (or estimate) the p-value for the test.

   (d) (3 points) State and interpret your conclusion.

12. Historically, a bank has employed 50% permanent full-time workers, 25% permanent part-time workers, 15% temporary full-time workers, and 10% temporary part-time workers. In a recent sample of 400 workers, 190 were permanent full-time, 125 were permanent part-time, 55 were temporary full-time, and 30 were temporary part-time. Use these data and $\alpha = 0.05$ to assess whether there has been a change from the historical percentages.

Category	Percent	Observed
permanent full-time	50%	190
permanent part-time	25%	125
temporary full-time	15%	55
temporary part-time	10%	30

   (a) (2 points) State the Null and Alternative hypotheses.

   (b) (3 points) Calculate the test statistic.

   (c) (3 points) Calculate (or estimate) the p-value for the test.

   (d) (3 points) State and interpret your conclusion.

ANSWERS

1. (a) 0.4   (b) 0.6

2. (a) $C_{18,3} \cdot C_{12,3} = 179\,520$
   (b) $C_{30,1} \cdot C_{29,1} \cdot C_{28,4} = 17\,813\,250$

3. (a) $\dfrac{60}{206} = 0.2913$
   (b) $\dfrac{32}{58} = 0.5517$
   (c) $\dfrac{23}{206} = 0.1117$
   (d) For example: $P(\text{satisfied} \mid \text{heart}) = 0.5517$ is not equal to $P(\text{satisfied}) = \dfrac{73}{206} = 0.3544$,
       therefore the events are not independent.

4. 0.5217

5. (a) 0.5   (b) 2.3   (c) 1.8466

6. 0.9139

7. (a) 0.3897   (b) 0.0823

8. 0.1841

9. $(0.6623, 0.8249)$

10. (a) $H_0 : \mu = 148.4$
        $H_a : \mu \neq 148.4$
    (b) $z = -1.84$
    (c) p-value ≈ 0.0658
    (d) We fail to reject H_0. There is insufficient evidence to claim that Jessica's true average time to swim
        the 200m butterfly is different from 148.4 seconds, at the 5% significance level.

11. (a) $H_0 : \mu_m - \mu_f = 0$
        $H_a : \mu_m - \mu_f > 0$
    (b) $t = 3.0073$
    (c) $0.005 < p$-value < 0.01
    (d) We reject H_0. There is sufficient evidence to claim that the true average hourly wage is smaller among
        female workers, at the 1% significance level.

12. (a) H_0 : distribution of workers at the bank fits the given historical distribution
        H_a : distribution of workers at the bank does not fit the given historical distribution
    (b) $\chi^2 = 9.6667$
    (c) $0.01 < p$-value < 0.025
    (d) We reject H_0. There is sufficient evidence to claim that the distribution of all workers at this bank does
        not fit the given historical distribution, at the 5% significance level.