$$F = P(1+rt) \quad F = P\left(1 + \tfrac{r}{n}\right)^{nt} \quad F = D\frac{\left(1+\tfrac{r}{n}\right)^{nt} - 1}{\tfrac{r}{n}} \quad P = R\frac{1 - \left(1+\tfrac{r}{n}\right)^{-nt}}{\tfrac{r}{n}} \quad APY = \left(1 + \tfrac{r}{n}\right)^{n} - 1$$

1. (8pts) Giorgio was pleasantly surprised to find $1098.24 in an account he forgot about. If this account bears 4.8% simple interest, and his money was in the account for 3 years, how much had he initially deposited?

2. (12pts) A certain payday lender (with offices in Murray), advertises on their website that you can get a $100 loan that you repay in 14 days with $115. What simple annual interest rate are they charging?

3. (9pts)   Isabella deposits $300 into an account bearing 5.19% interest, compounded quarterly. How much does she have in 2 years?

4. (11pts) A coffee-drinker realizes that he spends $3 every day on a cup of coffee. He ponders how much he would save in 2 years if instead he deposited this money daily into an account bearing 5.49%, compounded daily. While he ponders, you calculate and give the value of the account after two years.

5. (12pts) In 1992, your instructor could buy a gallon of milk for $1.99. In 2008 he pays $3.49 for a gallon of milk. What compounded annual "dairy" inflation rate does this growth correspond to?

6. (32pts) The Energizer Bunny's drum has worn out so he decides to get a new one for $725. He will finance this purchase at 16.23% interest, compounded monthly, for 4 years.

a) What is his montly payment on the loan?

b) What are his total payments over the course of the loan? How much of this amount is for interest?

c) How much does he owe after 1 year?

d) How much of his 13th payment goes toward interest, and how much towards the principal?

7. (16pts) Once you are out of college and have a job, you would like to save up for a new $23,000 car. If you can deposit $800 quarterly into an account bearing 7.3%, compounded quarterly, how long will it take until you have the desired amount?

Bonus. (10pts) Sally deposits $1,000 into an account bearing 4.4%, compounded weekly. For two years, she doesn't make any additional deposits. Then, she deposits $25 every week for three years. How much is in this account five years from the initial deposit of $1,000?

$\frac{a}{b} = \frac{1-P(E)}{P(E)}$ $P(E) = \frac{b}{a+b}$ $P(B|A) = \frac{n(A \text{ and } B)}{n(A)} = \frac{P(A \text{ and } B)}{P(A)}$

$P(A \text{ or } B) = P(A)+P(B)-P(A \text{ and } B) = P(A)+P(B)$ (if A and B are mutually exclusive)

$P(A \text{ and } B) = P(A) \cdot P(B|A)$ $P(A \text{ and } B) = P(A) \cdot P(B)$ if A and B are independent

1. (4pts) If 11 students got an A on an exam in a class of 28, what is the probability that a random student picked from this class got less than an A on the exam?

2. (4pts) Jason walks to a park every day. In one month (30 days), he noticed that his shoelace got untied on 5 days. What is the experimental probability that Jason's shoelaces get untied on one trip to the park?

3. (14pts) A bag contains five gummi bears, one in each of colors: green, red, yellow, orange and purple. We draw two gummi bears consecutively from the bag (without returning).
a) List all the equally likely outcomes of this experiment. How many are there?
b) List the outcomes on which a red or a yellow gummi bear was drawn.
c) What is the probability of drawing a red or a yellow gummi bear?

4. (12pts) The horse Tail End won 8% of the races it took part in during the season so far. The house odds on it are 12 to 1 in the next race.
a) If you think its chances of winning are determined by its record so far, is this a fair bet, and whom does it favor?
b) If you bet $25 on this horse, and it wins, how much will your bet return (in addition to your $25)?

5. (16pts) Suppose a multiple-choice exam has four possible answers for each question, only one of them correct. You get 5 points for each correct answer, lose 2 points for each incorrect answer and get nothing if you leave the question unanswered.
a) What is the expected point value of a random guess on this exam?
b) What is the expected point value if you can eliminate one of the answers as incorrect and choose a random answer from the remaining three?
c) Assuming you can always eliminate one answer and choose a random answer from the remaining ones, how many points would you expect to get on a test with 30 questions?

6. (12pts) A fashion retailer is offering 42 pre-matched outfits on their website. 23 of the outfits have solid tops, 31 have solid bottoms and 39 have either tops or bottoms solid. If an outfit is randomly selected, what is the probability that
a) both its top and bottom is solid?
b) neither its top nor its bottom is solid?

7. (20pts) A mail carrier encounters two mean dogs on his route. One of the dogs will chase him with 25% of the time, and the other will chase him with 12% of the time. Assume the two dogs act independently of each other. On a single run of the mail carrier's route, what is the probability:
a) that both dogs chase him?
b) that neither of the dogs chases him?
c) that at least one dog chases him?

8. (18pts) From a group of 15 American and 24 Japanese cars, two are chosen at random.
a) What is the probability that both cars are Japanese?
b) What is the probability that the second car is American, given that the first car was Japanese?
c) What is the probability that the second car is American?

Bonus. (10pts) Chocolate lover Siu-Ling tracks her chocolate-eating habits during many weekends and finds that she has chocolate on a Saturday 65% of the time. If she has chocolate on a Saturday, then she has it on the following Sunday 35% of the time. If she does not have chocolate on a Saturday, then she has it on the following Sunday 85% of the time. What is the probability that she has chocolate on exactly one day during a random weekend?

$$\text{angle} = (\text{relative frequency}) \cdot 360° \qquad Z = \frac{X - \mu}{\sigma}$$

$$\mu = \frac{x_1 + x_2 + \cdots + x_n}{n} \qquad \sigma = \sqrt{\frac{(x_1 - \mu)^2 + (x_2 - \mu)^2 + \cdots + (x_n - \mu)^2}{n}}$$

$$\mu = \frac{f_1 x_1 + f_2 x_2 + \cdots + f_n x_n}{f_1 + f_2 + \cdots + f_n} \qquad \sigma = \sqrt{\frac{f_1(x_1 - \mu)^2 + f_2(x_2 - \mu)^2 + \cdots + f_n(x_n - \mu)^2}{f_1 + f_2 + \cdots + f_n}}$$

1. (16pts) A 1994 Consumer Reports survey found that the rates for a single room at a selection of budget motels were 42, 40, 40, 40, 40, 50, 38, 48, 45, 40, 32, 45, 49, 34.
a) Find the mode of the data.
b) Find the median rate.
c) Find the mean rate.
d) Find the standard deviation.

2. (8pts) The median of a data set has the property that half the data is always below, and half is above the median. Give an example to show that the mean does not have this property. More precisely, give seven numbers so that five are below, and two are above the mean of the seven numbers. Compute the mean to verify.

3. (23pts) The frequency distribution of scores on worksheet 3 of my two 117 classes are shown below.
a) Draw a histogram for the data.
b) Find the median of the scores.
c) Find the mean of the scores.
d) Find the standard deviation of the scores.

Score	Frequency
30	16
29	8
28	4
27	2
24	3
23	4
18	4

4. (19pts) The distribution of tuition rates for in-state students for US public colleges for 1993 is shown on the next page (those were the days!). Do the following:
a) Find the relative frequencies.
b) Draw a pie chart (find angles first).
c) Enter a representative value for each interval.
d) Estimate the mean of data.

Range of Tuition	Number of Colleges	Relative Frequency	Angle	Representative Value
5000–5999	7			
4000–4999	31			
3000–3999	87			
2000–2999	181			
1000–1999	207			
0–999	12			

5. (20pts) Compute the following probabilities for a standard normal distribution. Draw a picture showing which area you are computing — shading is a good thing!

a) $P(-0.4 \leq Z < -0.21) =$

b) $P(Z > 0.33) =$

6. (14pts) In the late 1970s, the height of American males between the ages of 25 and 34 was approximately normally distributed with mean 70 inches and standard deviation 2 inches. Find the percentage of men whose height was between 66 and 76 inches.

Bonus. (10pts) a) For a standard normal distribution, find the 75-th percentile. (That is, find the number z_0 so that $P(Z \leq z_0) = 0.75$. Note that this is the reverse of our usual problem.) Draw a picture.

b) If scores on a test with many participants had a mean of 81 with standard deviation 9, which score will put you above 75% of the other test-takers? *Hint: use the answer from a).*

1. (23pts) An advertising agency has chosen the tagline "The world will end in _____!" as part of a campaign for a new cell phone. Copy writers voted on the last word in the tagline and the scores are below.

Number of votes:	4	3	1	3	2	4
"Fire"	1	1	2	3	2	3
"Ice"	2	3	1	1	3	2
"Desire"	3	2	3	2	1	1

> This problem brought to you by Robert Frost's **Fire and Ice**:
>
> Some say the world will end in fire,
> Some say in ice.
> From what I've tasted of desire
> I hold with those who favor fire.
> But if it had to perish twice,
> I think I know enough of hate
> To say that for destruction ice
> Is also great
> And would suffice.

a) Which word wins using the plurality method?

b) Which word wins using the plurality method, followed by a runoff of the two top finishers?

c) Which word is the Condercet winner, if any?

2. (16pts) A PTA board must determine what kind of fundraiser it will hold. The choices, as well as approval votes are shown below.

percent of votes:	13	15	10	14	11	12	12	13
Holding a carneval	X			X	X		X	
Selling magazines						X	X	X
Selling wrapping paper		X		X		X	X	
Holding an auction			X		X			X

a) Which option wins using the approval method?
b) If half of the 14% of voters from the fourth column favor holding a carneval, could they have obtained a preferable result by voting strategically, if the others voted as shown?

3. (12pts) Suppose there are 60 votes cast in an election between three candidates, decided by plurality. After the first 37 votes are counted, the tally is Wilson 15, Hoover 12, Coolidge 10.
a) What is the minimal number of remaining votes Wilson needs to be assured of a win?
b) What is the minimal number of remaining votes Coolidge needs to be assured of a win?
Justify your answers.

4. (10pts) If 75 votes are cast, what is the smallest number of votes a winning candidate can have in a four-candidate race that is decided by plurality? Justify your answer.

5. (23pts) Members of an experimental church are deciding on a piece of music to begin their Sunday services with. The preference rankings for the choices are below:

| Number of votes:	7	3	5	6	4	2
"Star Wars" theme	1	1	2	3	2	3
Madonna's "Like a Prayer"	2	3	1	1	3	2
Anthem of Panama	3	2	3	2	1	1

a) Which music wins using the Borda method?
b) Perform the check on the sum of Borda points.
c) Using the Borda method, could the four members from the fifth column obtain a preferable outcome by voting strategically, if the others voted as shown?

6. (16pts) Determine whether each of the following graphs has an Eulerian path or an Eulerian circuit. If it does, find it, if not, explain why not.
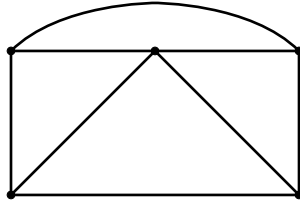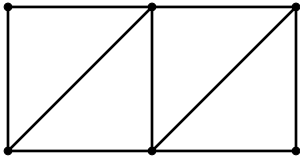
Bonus. (10pts) Find an approximate solution to the traveling salesman problem for a circuit starting at point A. Show the weight of the found circuits. Use (one on each picture)
a) the nearest neighbor algorithm
b) the greedy algorithm.
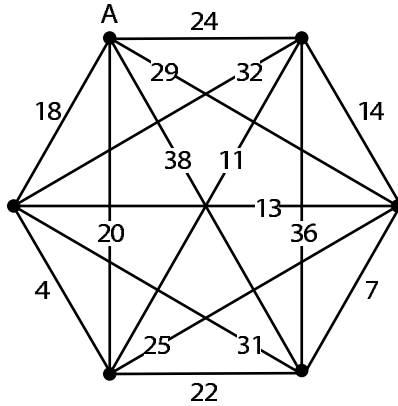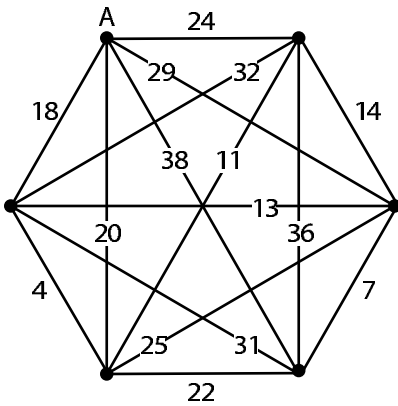
$$\text{angle} = (\text{relative frequency}) \cdot 360° \qquad Z = \frac{X - \mu}{\sigma}$$

$$\mu = \frac{x_1 + x_2 + \cdots + x_n}{n} \qquad \sigma = \sqrt{\frac{(x_1 - \mu)^2 + (x_2 - \mu)^2 + \cdots + (x_n - \mu)^2}{n}}$$

$$\mu = \frac{f_1 x_1 + f_2 x_2 + \cdots + f_n x_n}{f_1 + f_2 + \cdots + f_n} \qquad \sigma = \sqrt{\frac{f_1(x_1 - \mu)^2 + f_2(x_2 - \mu)^2 + \cdots + f_n(x_n - \mu)^2}{f_1 + f_2 + \cdots + f_n}}$$
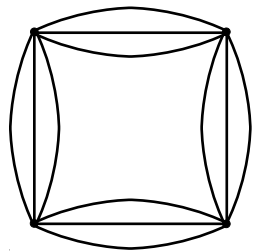
$$\frac{a}{b} = \frac{1 - P(E)}{P(E)} \qquad P(E) = \frac{b}{a+b} \qquad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(B|A) = \frac{n(A \text{ and } B)}{n(A)} = \frac{P(A \text{ and } B)}{P(A)}$$

$$P(A \text{ and } B) = P(A) \cdot P(B|A) \qquad P(A \text{ and } B) = P(A) \cdot P(B) \text{ if } A \text{ and } B \text{ are independent}$$

$$F = P(1 + rt) \quad F = P\left(1 + \frac{r}{n}\right)^{nt} \quad F = D\frac{\left(1 + \frac{r}{n}\right)^{nt} - 1}{\frac{r}{n}} \quad P = R\frac{1 - \left(1 + \frac{r}{n}\right)^{-nt}}{\frac{r}{n}} \quad APY = \left(1 + \frac{r}{n}\right)^n - 1$$

1. (8pts) Determine whether the following graph has an Eulerian path or an Eulerian circuit. If it does, find it, if not, explain why not.

2. (10pts) Compute the following probability for a standard normal distribution. Draw a picture showing which area you are computing — shading is a good thing!

$$P(-0.63 \le Z < 1.31) =$$

3. (27pts) A group of film critics are choosing their favorite recent foreign film. The preference rankings for three candidates are below:

Percent of votes:	11	25	30	6	11	17
4 months, 3 weeks & 2 days,	1	1	2	3	2	3
Alexandra	2	3	1	1	3	2
Persepolis	3	2	3	2	1	1

a) Which film wins using the plurality method?
b) Which film wins using the Plurality with runoff method?
c) Which film wins using the Borda method?
d) Perform the check on the sum of Borda points.
e) In the Borda method, can the 17% of voters from the last column obtain a preferable outcome if they voted strategically?

4. (23pts) The age distribution of a class is shown in the table.
a) Draw a histogram for the data.
b) Find the median age.
c) Find the mean age.
d) Find the standard deviation.

Age	Frequency
17	2
18	7
19	13
20	9
21	6
22	3

5. (13pts) A bag contains 7 red balls and 11 green ones.
a) If one ball is drawn from the bag, what is the probability that it is green?
b) If two balls are drawn from the bag, what is the probability that the second one is red, given that the first one was red?
c) If two balls are drawn from the bag, what is the probability that both are green?

6. (17pts) A game of chance is set up as follows: you roll two dice and win $4 if 3 or 7 is the sum on the dice. It costs $1 to play (this $1 is not returned when you win).
a) What is the probability of getting a sum of 3 or 7 on one roll of dice?
b) What is the expected gain or loss on one play of this game?
c) If you play 20 times, how much do you expect to gain or lose overall?
d) Is this game a fair bet?

7. (8pts) In a group of 23 computers, 11 have Quicktime player installed, 9 have Winamp installed, and 5 have both media-playing programs installed. If a computer is randomly selected from the group, what is the probability that it has either of the programs installed?

8. (8pts) If \$11,000 is deposited into an account bearing 3.17%, compounded weekly, how much is in the account after three-and-a-quarter years?

9. (10pts) When her daughter is born, Joanna decides to save \$250,000 to buy her a house or fund her college when she turns 18. How much should she deposit every quarter into an account bearing 9%, compounded quarterly?

10. (16pts) Britney Spears needs to borrow $300,000 for a plastic operation that will change her appearance to the point where no one can recognize her. Suppose she can get a 20-year loan with interest rate 8%, compounded monthly.
a) What is her monthly payment?
b) What is the balance on the loan after 5 years?

Bonus. (14pts) In the late 1970s, the height of American women between 25 and 34 years of age was normally distributed with mean 64.5 inches and standard deviation 2 inches. Suppose we choose two women at random. What is the probability that the height of both of them is between 66 and 68 inches? (Assume their heights are independent of each other.)