

Mathematical Concepts — Joysheet 1
MAT 117, Fall 2012 — D. Ivanišić

Name: _____
Show all your work!

Use your calculator to compute each expression to 6 significant digits accuracy or six decimal places, whichever is more accurate. Write down the sequence of keys you entered in order to compute each expression. Do not round numbers in mid-computation.

1. (5pts) $\sqrt[7]{17} =$

2. (9pts) $2400 \left(1 + \frac{0.03}{12}\right)^{24} =$

3. (7pts) $15(\sqrt[10]{3} - 1) =$

4. (6pts) $\frac{\log 5.34}{\log 0.033} =$

5. (9pts) $\frac{\log 8.51}{12 \log 3.59} =$

6. (12pts) $\frac{\left(1 + \frac{0.0425}{12}\right)^{60} - 1}{\frac{0.0425}{12}} =$

7. (12pts) $\frac{1 - \left(1 + \frac{0.03}{4}\right)^{-20}}{\frac{0.03}{4}} =$

4. (12pts) A \$2000 investment in stock of an oil company gained 35% in six months, as oil prices rose. In the next six months the stock lost 30% of its value. How much is it worth at the end of the year-long period? Did the investment make or lose money?

5. (10pts) How much money should you deposit in a simple-interest account bearing 3.05% if you would like to have \$2000 in fifteen months? How much of the final \$2000 is from interest?

6. (10pts) A cash-advance service with offices in Murray is offering the following deal: borrow \$150 today and repay us with \$176.47 in two weeks. What interest rate are they charging on this short-term loan?

Mathematical Concepts — Joysheet 3
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1. (8pts) Steve would like to have \$3000 for a nice dinner table. How much should he deposit now in an account bearing 3.15%, compounded daily, in order to have the desired amount in two and a half years? How much of the \$3000 came from interest?

2. (6pts) Bank of Elephant is offering a 1.35% interest rate on an account that is compounded quarterly, while Donkey Bank has an account at 1.34%, compounded monthly. Which account is the better deal?

3. (10pts) An investment you are considering is expected to grow at 15%, compounded annually. How long until your investment triples?

4. (10pts) To save for a pool, the Hwangs deposit \$1500 every quarter into an account bearing 2.25% interest, compounded quarterly.

a) How much do they have in the account in 3 years?

b) How much did they earn in interest over these 3 years?

5. (14pts) At the time of little Jason's birth, his parents decided to save some money for his college. They deposit \$4000 immediately into an account bearing 5.2% interest, compounded monthly, and make no further deposits for a while. Then, when Jason went to public kindergarten at age 5, they did not have to pay for day care any more, so they set aside \$350 every month in the same account.

a) How much is in the account when Jason is 18?

b) How much of it was from deposits, and how much from interest?

6. (12pts) Mikayla would like to save \$2,500 for a fancy refrigerator. If she can set aside \$125 every month into an account bearing 4.56%, compounded monthly, how long will it take her to save the desired amount?

This is an exercise in computing the payment on a hypothetical loan and comparing it with the numbers that financial services websites give you. Do the following:

1. (4pts) Decide on an amount and purpose for a hypothetical loan (e.g. buying a car, house, starting a business, etc.) Choose over how many years it should be repaid. Standard choices for each category are suggested: 15, 20, 30 years for a home, 3, 4, 5 years for a car, etc.

2. (14pts) Find a financial services website (bank, mortgage originator) that gives you interest rate quotes for the kind of loan that you chose and computes the monthly payment based on a loan amount. Use their computation to find the monthly payment on your hypothetical loan. **Don't use a website with a "generic" calculator such as bankrate.com, rather, find one that offers actual loans with current interest rates.** Print out the webpage, showing loan amount, term, interest rate and payment and attach it to this one. Try to keep it to just one sheet.

(Attachment)

3. (12pts) Using our loan formula from 8.5, compute (write the computation here) the monthly payment on your hypothetical loan. Use the interest rate that you found on the website. The frequency of compounding is typically monthly. Does your number agree with the information on the website you found?

4. (14pts) Find the balance of the hypothetical loan after two thirds of all payments have been made.

5. (16pts) Write an amortization schedule for the four payments after two thirds of all payments have been made. (For example, if it's a 60-month loan, consider payments 41, 42, 43 and 44.)

3. (8pts) At a restaurant, you can choose from seven meats, twelve sides and five types of salads. If your idea of a good meal is a combination of a meat with a side and a salad, how many different meals could you order?

4. (10pts) Suppose a bank card has six digits, where the first one cannot be a zero. The sixth digit is a “check-digit”, whose value is the remainder of the sum of the first five digits divided by 10. (For example, if the first five digits are 25475, with sum 23, the sixth digit is 3.) How many different bank cards can be issued?

5. (12pts) A die is rolled four times.

- a) How many different outcomes are there to this experiment?
- b) How many different outcomes have a 2 on the third roll?

Mathematical Concepts — Joysheet 6
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Show all your work!

1. (10pts) In 2012, elections are held for 33 Senate seats. The table below breaks down the current make-up of the senate by party affiliation and whether the senator does not face an election this year, is running for re-election, or is retiring from the Senate.

Party	Dem.	Ind.	Rep.
No election	30	0	37
Incumbent running	15	1	3
Incumbent retiring	6	1	7

If a current random senator is selected, what is the probability that the senator
 a) is a Democrat? b) is an incumbent running?
 c) a retiring Republican?
 d) does not face an election in 2012?

2. (20pts) Write the probabilities and odds against and in favor of the following events (show any work needed below):

Event	probability	odds against	odds in favor
a) Drawing a jack from a deck of cards			
b) Rolling an odd number on a die			
c) Drawing a black odd-number card from a deck of cards			
d) Getting exactly one tail on three coin tosses			
e) Getting numbers 1 apart on a roll of two dice (e.g., 3 and 4)			

3. (4pts) The odds against that a certain tree loses its leaves before Nov. 1st are 7-to-5.

- a) What is the probability the tree loses its leaves before Nov. 1st?
- b) What is the probability the tree doesn't lose its leaves before Nov. 1st?

4. (4pts) 36% of all readers' comments on a news website are obnoxious.

- a) What are the odds in favor of randomly choosing an obnoxious comment?
- b) What are the odds against randomly choosing an obnoxious comment?

5. (12pts) Two dice are rolled. What is the probability that

- a) sum is 3 or 8?
- b) numbers on the dice are equal or both are odd?
- c) at least one of the numbers is even?

6. (10pts) At the KDQ department store, 42% of apparel items are discounted, 13% have been in the store less than a month, and 51% of items are discounted or have been in the store less than a month. What is the probability that a randomly chosen apparel item

- a) is discounted and has been in the store less than a month?
- b) is not discounted or it hasn't been in the store less than a month?

Mathematical Concepts — Joysheet 7
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Show all your work!

1. (12pts) On your commute to class you encounter a red or green traffic light that is red 37% of the time. What is the probability that you
- a) encounter red on every day of two days of going to class?
 - b) encounter green on every day of three days?
 - c) encounter green on at least one of four days?

2. (14pts) A bag contains 13 chestnuts, 10 pecans and 5 walnuts. Three nuts are drawn without replacement. What is the probability that:
- a) the second is a pecan, given that the first one is a walnut?
 - b) all three are chestnuts?
 - c) first is a chestnut, second is a pecan?
 - d) at least one is a walnut?

3. (10pts) The table shows the make-up of an automobile dealer's lot by brand and type of vehicle.

What is the probability that a random vehicle:

- a) is a Ford?
- b) is an SUV?
- c) is a Lincoln SUV?
- d) is an SUV, given it is a Lincoln?
- e) is a Ford, given it is a car?

Type	Ford	Lincoln	Total
Car	35	18	
SUV	32	20	
Truck	25	3	
Total			

4. (10pts) A multiple choice test has 5 answers on every question, two of which are correct. You are to select only one answer, and you get 4 points for a correct answer, 0 points for not attempting a question, and 3 points are subtracted for an incorrect answer.

- a) What is the expected value of a random guess?
- b) If you can rule out one answer as incorrect, what is the expected value of a random guess?
- c) If you can always rule out one answer as incorrect and randomly choose an answer among the remaining four, how many points can you expect to have on a 30-question test?

5. (14pts) Dogs Abe, Bo and Charlie compete at a racetrack. Abe wins 36% of races, Bo wins 23% of races, Charlie wins 30% of races, and on 11% of races the dogs lose interest and don't finish. A game of chance is set up as follows: A player pays \$10 and collects \$20 if Bo wins, \$4 if Abe wins, \$12 if Charlie wins, and nothing if the dogs lose interest.

- a) Find the expected value of this game.
- b) If you play this game 40 times, how much do you expect to win or lose?
- c) What is the fair price of this game?

3. (10pts) A day care center examines how many babies are left to their care every day over a 20-day period (four working weeks) They number listed below.

- a) Find the midrange of the data. 2, 3, 5, 7, 8, 8, 7, 6, 5, 4, 3, 3, 5, 5, 7, 6, 6, 8, 6, 5
b) Find the median of the data.
c) Find the mean of the data.

4. (20pts) Over 40 days, a restaurant counts how many times a new dish is ordered every day. The numbers are shown below. Do the following:

- a) Draw a histogram for the data.
b) Find the midrange of the data.
c) Find the median of the data.
d) Find the mean of the data.

Times ordered	Frequency (days)
1	3
2	5
3	6
4	5
5	9
6	8
7	4

Final answers should have accuracy to 6 decimal places (or 4 decimal places for table-derived answers). Show some work how the mean and standard deviation are computed. *Giving only the answer will bring you few points.*

1. (18pts) A number of bands were analyzed to determine how many hits they had over a five-year period (according to some definition of what a “hit” is). The number of hits is recorded below.

- a) Find the range of the number of hits.
- b) Find the mean number of hits.
- c) Find the standard deviation of the number of hits.

Number of hits	Frequency (bands)
1	5
2	4
3	11
4	16
5	9
6	3
7	2

2. (10pts) The life-span of a certain light bulb is normally distributed with mean 2,500 hours and standard deviation 200. Use the 68-95-99.7 rule (draw a picture) to find the percentage of light-bulbs that lasted:

- a) between 2,300 and 2,700 hours
- b) under 2,100 hours
- c) over 2,700 hours
- d) between 1,900 and 2,300 hours

3. (6pts) A set of data items is normally distributed with mean 23 and standard deviation 5.1. Find the data items that correspond to the z -scores given below.

a) $z = 0$

b) $z = 1.3$

c) $z = -2.2$

4. (4pts) Kate scored 14 points on an exam with mean 20 and standard deviation 4, and Kacie scored 43 points on a similar exam with mean 50 and standard deviation 5. Use z -scores to determine who did worse.

5. (22pts) The rainfall for the month of May at a certain location is normally distributed with mean 10.4 inches and standard deviation 2.1 inches. Draw a picture showing which area you are computing as you answer:

a) What percentage of Mays has rainfall between 9 and 12 inches?

b) What percentage of Mays has rainfall greater than 13 inches?

c) What is the percentile of May rainfall of 8.5in? What does this mean?

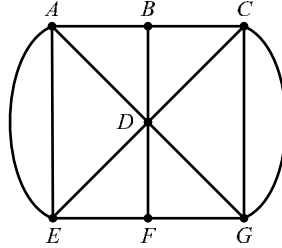
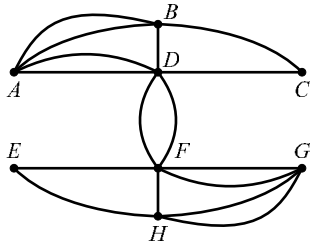
d) What is the probability that in a random May the rainfall is under 7 inches?

1. (30pts) A car-rental company is considering upgrading part of its fleet with vehicles from one manufacturer. Competitive proposals were submitted by Chevrolet, Dodge, Hyundai and Toyota, and the company asks its regional managers to rank the four proposals. It will decide on the manufacturer based on these rankings.

Votes	6	4	3	3	1	7	5	4
1st	C	C	D	D	T	T	H	H
2nd	D	D	C	C	D	H	D	T
3rd	H	T	H	T	H	C	T	C
4th	T	H	T	H	C	D	C	D

- Which choice wins the vote in a plurality election?
- Which choice wins the vote in a plurality election with elimination?
- Which choice is the pairwise comparison winner?
- Which choice is the winner using Borda's method? Perform the check on the sum of Borda points.

2. (12pts) Determine whether each of the following graphs has an Euler path or an Euler circuit. If it does, find it, if not, explain why not. Write the sequence of vertices Euler paths or circuits go through.



3. (18pts) A soda distributor wishes to restock vending machines in Clinton, Fulton, Mayfield and Murray while minimizing total distance traveled. The table below has the distances between the cities.

- Draw a weighted graph that corresponds to this problem.
- Use the brute force method to find the route that minimizes the distance traveled. First list all the possible orders of visits with Murray the starting city.
- Use the nearest neighbor algorithm to find an approximate solution to the problem. Is it the same as in b)?

	C	F	Ma
F	15		
Ma	23	22	
Mu	45	35	25