

Mathematical Concepts — Joysheet 1
MAT 117, Spring 2011 — D. Ivanšić

Name: _____
Show all your work!

Use your calculator to compute each expression to 6 significant digits accuracy. Write down the sequence of keys you entered in order to compute each expression. Do not round numbers in mid-computation.

1. (5pts) $\sqrt[3]{21} =$

2. (9pts) $1450 \left(1 + \frac{0.03}{12}\right)^{36} =$

3. (7pts) $4(\sqrt[12]{5} - 1) =$

4. (6pts) $\frac{\log 0.3345}{\log 7.34} =$

5. (9pts) $\frac{\log(6.35)}{17 \log 3.17} =$

6. (12pts) $\frac{\left(1 + \frac{0.045}{12}\right)^{24} - 1}{\frac{0.045}{12}} =$

7. (12pts) $\frac{1 - \left(1 + \frac{0.0575}{12}\right)^{-180}}{\frac{0.0575}{12}} =$

4. (8pts) The Watsons would like to buy a \$17,000 car sometime in the near future. How much should they deposit now in an account bearing 3.675%, compounded quarterly, in order to have the required amount in two years?

5. (13pts) Aunt Polly suddenly remembered that, three-and-a-half years ago, she deposited \$2000 into an account that compounds daily. She checked the balance and found \$2500 in the account. What is the annual interest rate on this account? (Assume 360 days in a year.)

6. (13pts) You have the opportunity to invest in an account that bears 9% interest, compounded quarterly. How long will it take for your money to double?

4. (16pts) At the time of little Ella's birth, her parents had \$5,000 in savings. They would like to have \$100,000 for Ella's college by the time she is 18. They can get 5.5% interest in an account compounded quarterly, and they invest the \$5,000 in this account. How much should they additionally deposit into this account every quarter in order to have the target amount? Including the \$5,000, what was the total amount of their deposits? *Hint: treat this situation as two different accounts, whose goal is to have a total of \$100,000 between them.*

5. (10pts) Little Jenna, who was in the same maternity ward as Ella, was born to poor parents who were not able to save for her college. After high school, determined to go to college, Jenna takes out a student loan for \$85,000, with an interest rate of 5.5%, compounded quarterly. She repays this loan over 18 years with equal quarterly payments. What is the amount she pays every quarter?

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 that computes a monthly payment based on a loan amount. Many banks' or mortgage originators' websites have mortgage calculators, for example. Use their calculator and the actual interest rate that they offer to find the monthly payment on your hypothetical loan. 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 3.5, 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.)

Mathematical Concepts — Joysheet 6
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Show all your work!

1. (8pts) A curious observer counts the number and type of vehicles passing through a street on several Wednesday afternoons. She obtains the following results:

Vehicle	car	SUV	pick-up	heavy truck
Number	67	53	59	33

If a random vehicle is observed on a Wednesday afternoon, what is the empirical probability that it is

- a) an SUV?
- b) a heavy truck?
- c) not a car?

2. (17pts) Write the probabilities and odds against and in favor of the following events (you can show any work needed below):

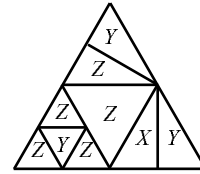
Event	probability	odds against	odds in favor
a) Rolling a 3 on a die			
b) Drawing a 7 or a 9 from a deck of cards			
c) Drawing a red face card from a deck of cards			
d) Getting two heads on two coin tosses			
e) Getting sum 3 or 10 on a roll of two dice			

3. (4pts) The odds against rain tomorrow are 7-to-2.
- What is the probability that it rains tomorrow?
 - What is the probability that it does not rain tomorrow?

4. (4pts) The probability of seeing a rainbow on May 1st is $\frac{2}{99}$.
- What are the odds against seeing a rainbow?
 - What are the odds in favor of seeing a rainbow?

5. (13pts) A bean bag is tossed onto the triangular field shown. What is the probability that the bean bag lands on:

- a field labeled X?
- on a field labeled Y?
- a field labeled X or Z?
- What are the odds against landing on X or Y?



6. (14pts) At a charity event, the following game of chance involving a single die is played: a player pays \$5 and collects \$15 if they roll a 6, \$7 if they roll a 2 or a 4, and nothing if they roll a 1, 3 or a 5.
- Find the expected value of this game.
 - What is the fair price of this game?
 - The event organizers expect that 150 plays will be made. How much do they expect to collect from this game? How much should they charge per play in order to expect collecting \$100 from this game?

1. (18pts) A bag contains four red balls and two green balls. Two balls are drawn without replacement. (For this problem distinguish between the balls of the same color.)

a) Determine the number of points in the sample space.

b) Construct a tree diagram (you can draw it only partially) and list the sample space.

Determine the probability that:

c) the first ball was red and the second was green.

d) exactly one of the balls was red.

e) exactly one of the balls was green.

f) at least one ball was green.

2. (13pts) At a popular restaurant, the probability of getting seating on a Saturday within a half-hour of arrival is 35%. Assume that getting seating on different Saturdays are independent events. What is the probability of

a) getting seating on two different Saturdays?

b) getting seating at least once on two different Saturdays?

c) not getting seating on five different Saturdays?

3. (5pts) A women's shoe store has 45 boxes of shoes that are flats or have a peep-toe. If 32 boxes have shoes with a peep-toe and 24 boxes have flats, what is the probability that a randomly chosen box contains flats with a peep-toe?

4. (12pts) Two cards are drawn from a standard deck, without replacement. What is the probability that:

- a) both cards are face cards?
- b) neither card is a number between 4 and 7?
- c) at least one card is an ace?

5. (12pts) The table below shows the pattern of payment methods at a certain grocery store on one fine Wednesday. What is the probability that a random shopper:

- a) paid by cash or check?
- b) was over 40?
- c) paid by credit card, given they were under 40?
- d) paid by debit card, given they were over 40?

Age	Cash or Check	Debit Card	Credit Card	Total
under 40	15	32	51	
over 40	35	21	27	
Total				

2. (10pts) Marsha, a server at a restaurant, examines the amounts she received in tips on Fridays and Saturdays over the course of a month. They are listed below (in dollars).

a) Find the midrange of the data.

b) Find the median of the data.

23, 37, 32, 25, 28, 32, 19, 24

c) Find the mean of the data.

3. (21pts) The track team at Calloway Lake University records the number of 1st–3rd places the team wins in a season. The data over many seasons is in the table 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.

1st–3rd places	Frequency (seasons)
0	3
1	7
2	8
3	6
4	4
5	1

Bonus. (2pts) Use the grade computer on the website to determine your grade in the course so far. Assume you are getting 3 points for participation, and no bonus for attendance. Write down your course average so far, and what you would need on the next exam to increase it by a letter grade.

Mathematical Concepts — Joysheet 9
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Show all your work!

Final answers should have accuracy to 6 decimal places. Show some work how the mean and standard deviation are computed. *Giving only the answer will bring you few points.*

1. (18pts) Every morning at sunrise, an ornithologist (a biologist with a focus on birds) counts the number of herons at a pond, with the data below.
- Find the range of the data.
 - Find the mean of the data.
 - Find the standard deviation of the data.

Number of birds	Frequency (days)
0	12
1	3
2	4
3	21
4	14
5	5
6	8
8	2

2. (20pts) Compute the following areas under a standard normal distribution curve. Draw a picture showing which area you are computing.

a) $A(Z \leq 0.44)$

b) $A(-0.12 < Z)$

c) $A(-0.22 < Z < 0.54)$

d) $A(0.37 \leq Z)$

3. (22pts) The warranty on a car battery is 48 months. Assume the breakdown times are normally distributed with mean 57 months and standard deviation of 8 months. Draw a picture showing which area you are computing as you answer:

- a) What percentage of batteries will require replacement under warranty?
- b) What percentage of batteries will last to at least 72 months?
- c) What percentage of batteries will last between 42 and 54 months?

1. (26pts) An automobile insurance company is deciding which animated character to use as its spokesperson. The preference rankings of the board members are shown below, from the choices: cocker-spaniel, firefly and ostrich.

Votes:	7	2	5	3	4	3
1st	C	C	F	F	O	O
2nd	F	O	C	O	C	F
3rd	O	F	O	C	F	C

- Which choice wins the vote in a plurality election?
- Which choice wins the vote in a plurality election with a runoff?
- 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. (34pts) A poll of members of a community asked people to rank their preferences on a curfew for young people under the age of 18. The choices were 10PM, 12AM, 1AM, and no curfew. Their preference rankings broke down into the following percentages.

Votes	9	2	6	20	4	17	10	32
1st	10P	12A	12A	12A	1A	1A	1A	no
2nd	12A	10P	1A	1A	12A	12A	no	1A
3rd	1A	1A	10P	no	10P	no	12A	12A
4th	no	no	no	10P	no	10P	10P	10P

- Which choice wins the vote in a plurality election?
- Which choice wins the vote in a plurality election with elimination (see book)?
- 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.