

Harnessing the Power of Technology

to facilitate a creative approach
to improve student engagement and
assessment

OCMA

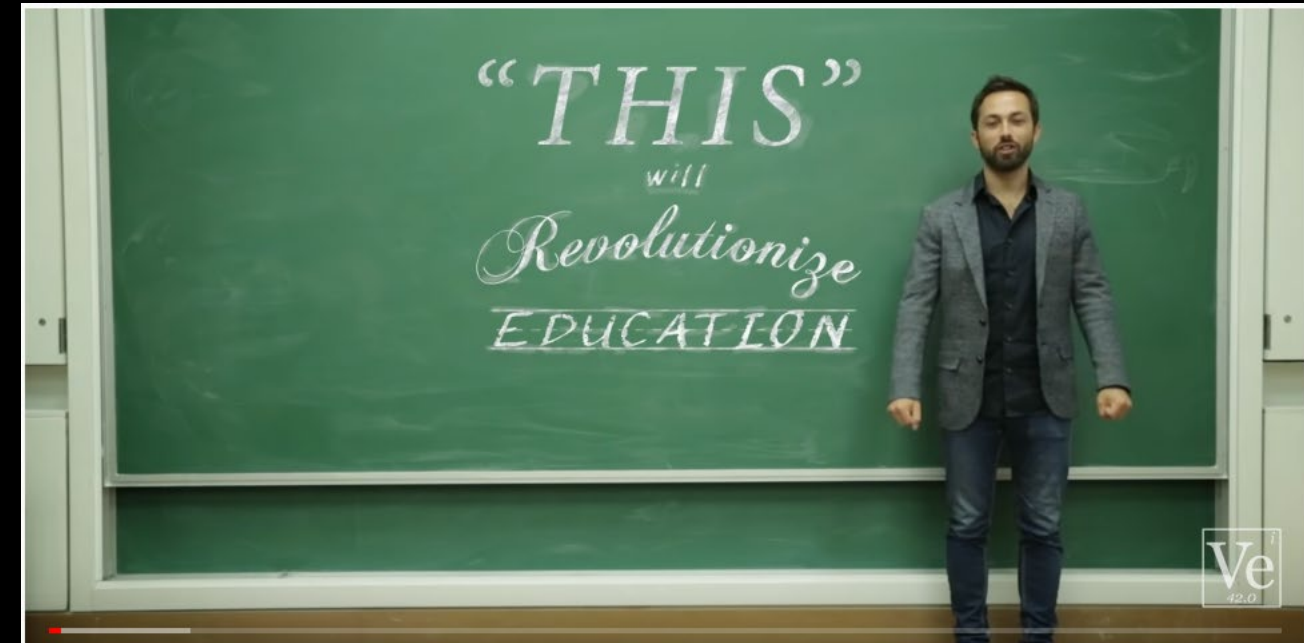
October 26, 2021



Frosina Stojanovska-Pocuca

What a year it has been!

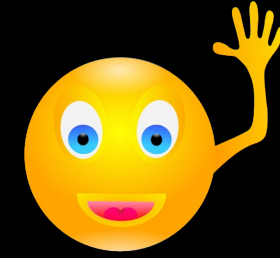
- ❑ Deployed Technology to help teachers build adequate and effective techniques
 - ✓ Bridging the gap between Pedagogy and Technology
 - ✓ Be used as part of synchronous/asynchronous lectures/tutorials
 - ✓ Inclusive technology practices in teaching, learning and assessment can benefit all students



<https://www.youtube.com/watch?v=GEmuEWjHr5c>

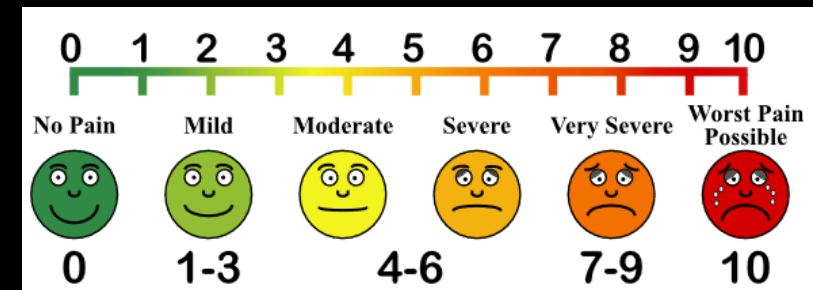
What a year it has been!

- ❑ How to Engage our students?
- ❑ How to Assess their acquired knowledge?



<https://publicdomainvectors.org>

- ✓ Instigate a Culture of Learning;
- ✓ Provide ongoing, merciless support;
- ✓ No proctoring;



<https://publicdomainvectors.org>

Disclaimer:

The strategies presented here today are not new, and they may be already in your toolbox.

- Before we started

- ✓ Survey
- ✓ Course Content

- Delivery and Assessments

- ✓ Brain Brakes
- ✓ Learning Strategies
- ✓ About Assessments
- ✓ Participation
- ✓ Math Escape Room



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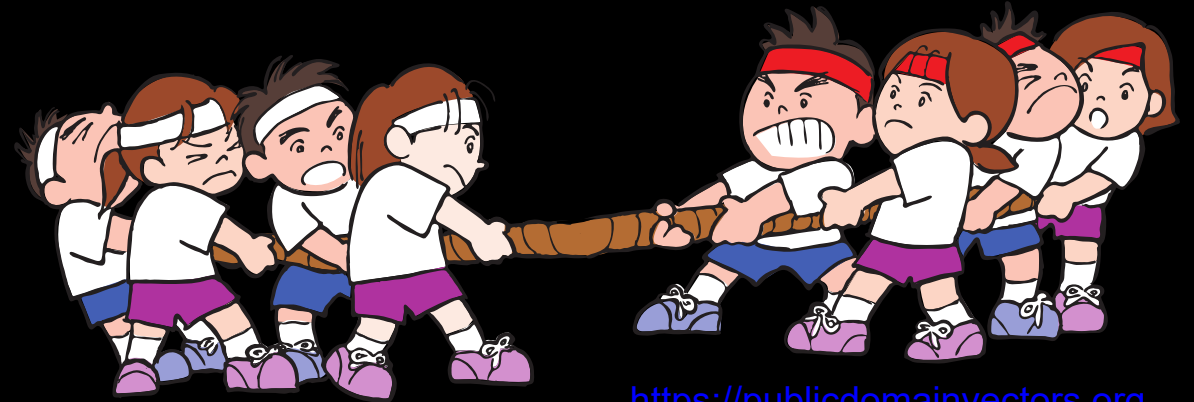
I hope this presentation inspires upon an activity or an inquiry that you may bring to your students.

About my Students...

- First year Computer Science (Software and Networking)

- Different strategies:

- ✓ Surveys;
- ✓ Recording mini-lectures
- ✓ Reflective assessments
- ✓ Open book exams with questions that require more critical and analytical way to answer
- ✓ Additional opportunities to show what they learned



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Before we started...

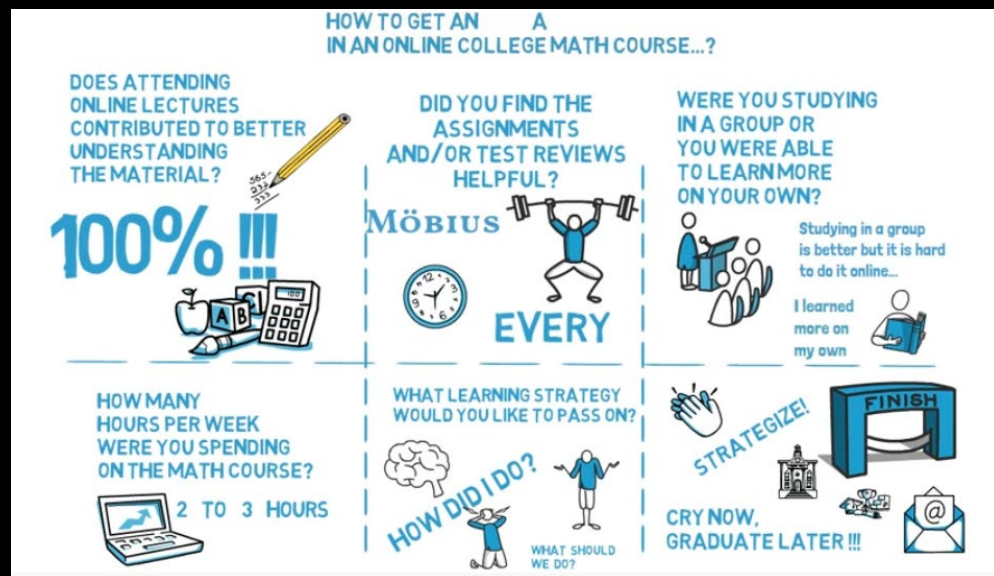
❑ Summer 2020:

A survey to students who scored
90+ on Test 1

- ✓ Would you like to share some strategies on how you made those great results and what would you like to say to the incoming students.

“My learning strategy depended heavily on attending lectures and writing the assignments multiple times. The “How did I do?” button was a good friend to me.”

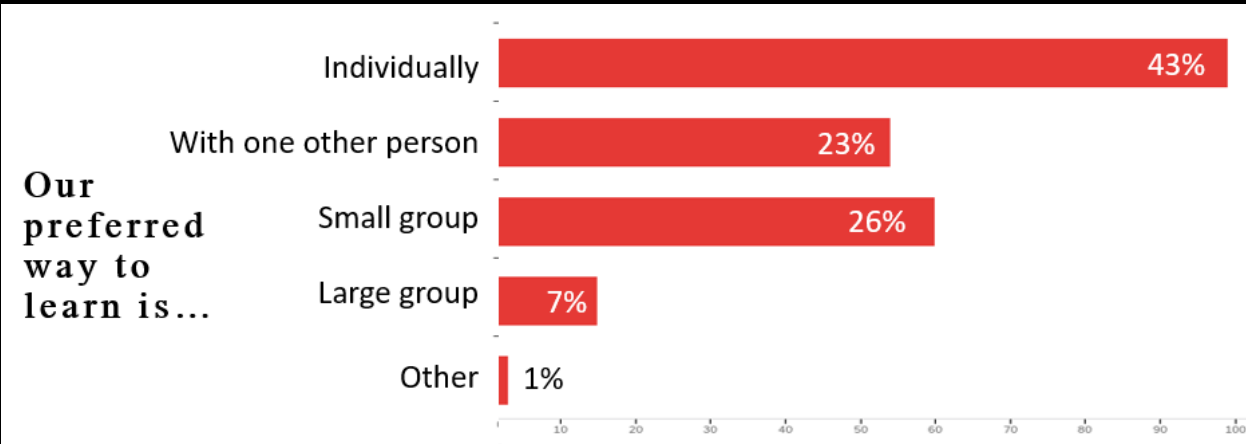
“Doing the assignments as soon as they opened. ...”



“Attending classes was most definitely the fastest way for me to learn. I had a pencil, paper, and calculator always with ...”

First Survey

- During week 1, a survey is sent to students to get to know them better...



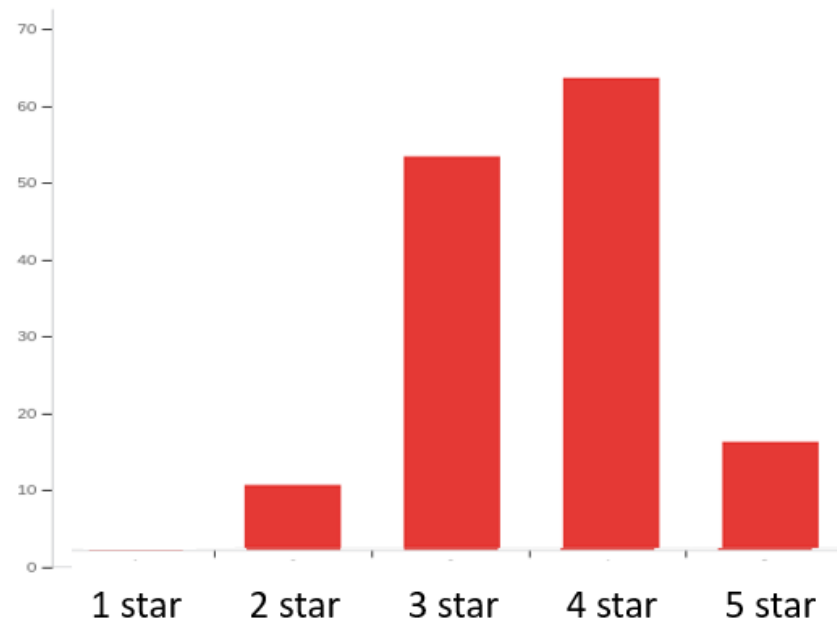
Attending online lectures are...

An average of 93.5%

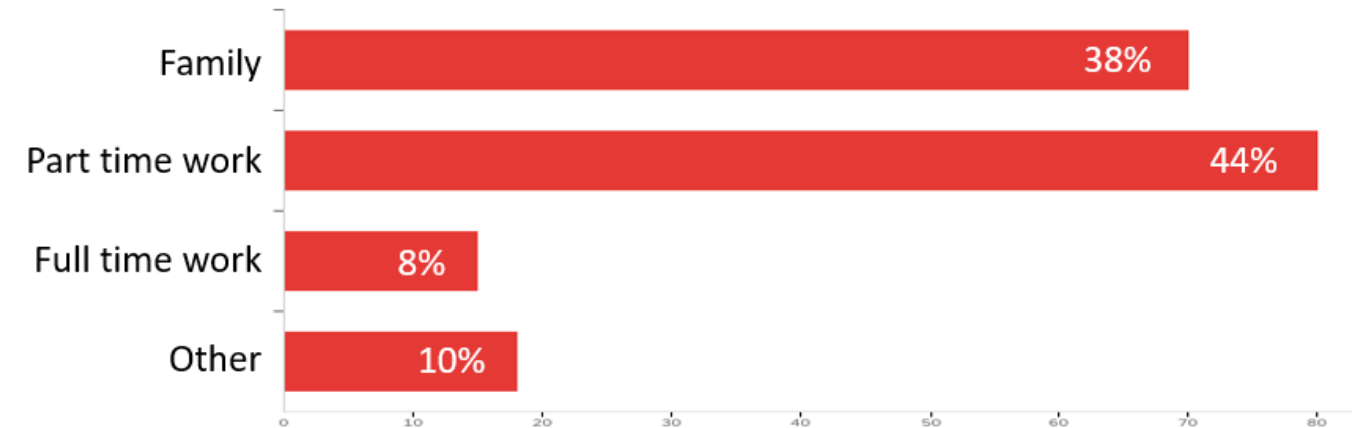
Hours planned for weekly homework are...

An average of 5.2 hours

Our time management skills are...



We have other commitments and responsibilities...



First Survey

➤Expectations from the teacher

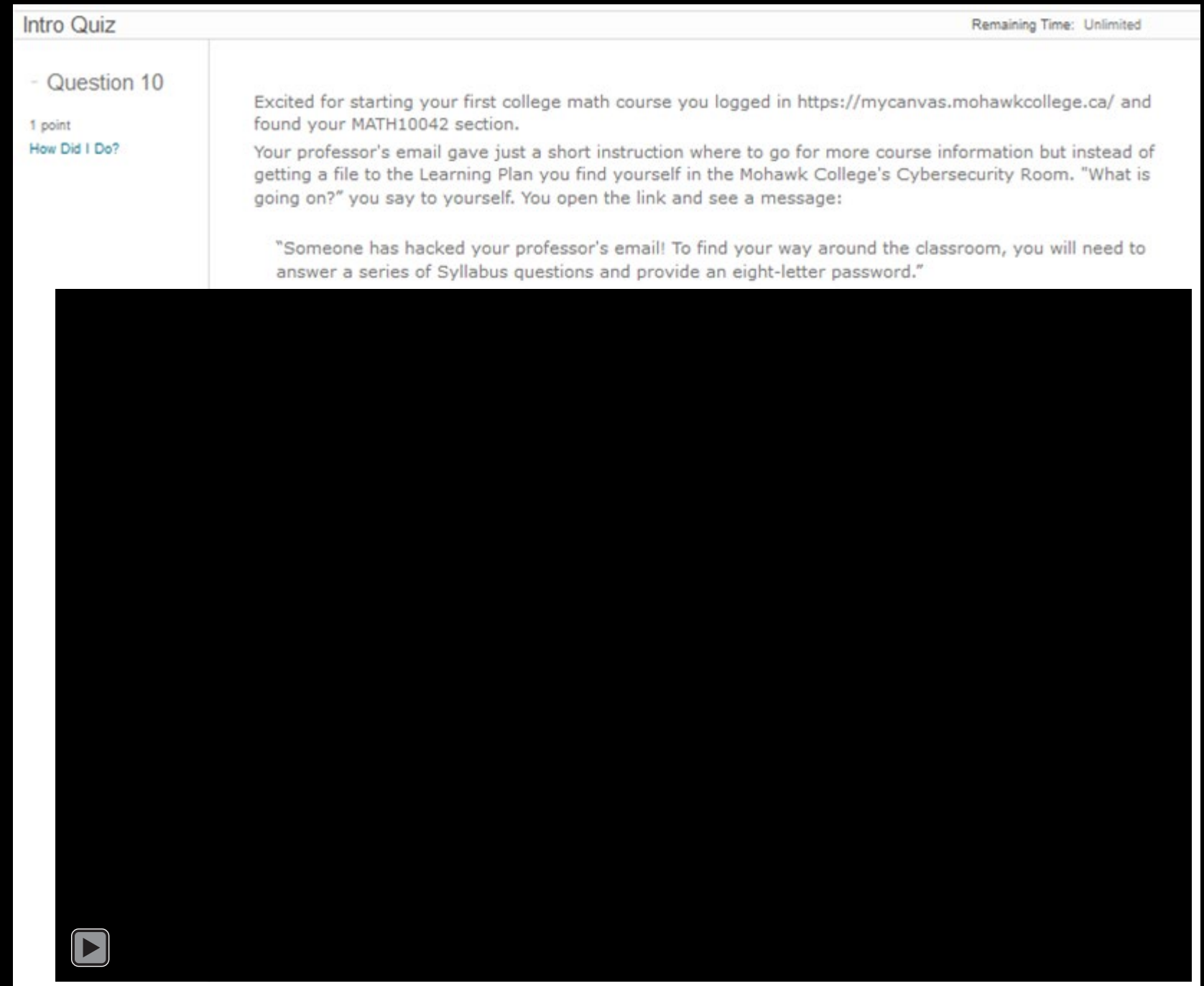
- To be understanding, accepting, and to treat their students with respect.
- To be patient, approachable and accessible.
- To explore different solutions to problems or engage the class in different ways.
- To provide a positive interactive experience in a stress-free environment.
- To accurately present material, and to be approachable with questions and concerns if needed.

➤Expectations from students

- Come to our online class - if you miss a class, ask a friend for notes, check MyCanvas what was covered;
- Ask for help as soon as needed:
 - ask the teacher for help with concrete questions;
 - book an online appointment with our [Student Success Mentors](#) for some extra support!
- Be open for learning, apply yourself;
- Work on the homework more frequently during the week;
- Start working on Mobius Assignments as soon as they open;
- When in doubt, send me an email/ask in class.

Course Content

- ❑ It is on the Syllabus!
- ✓ Helps you know what to expect from the course during the semester
- ✓ How about a Quiz?



Course Content

□ Roadmap;

möbius

Video Lessons

Module 1 ✓	1.1 Prime Numbers and Prime Factorization
Module 2	
Module 3	

- 1.1.1 Introduction to Prime Numbers (1:09)
- 1.1.2 Test for Primality (1:08)
- 1.1.3 Fundamental Theorem of Arithmetic (0:16)
- 1.1.4 Prime Factorization of a Composite Number (3:31)
- 1.1.5 Divisibility Tests

□ Universal Design of Learning;

Within the roman numerals there is no representation of 0 (zero). It will be very difficult to perform arithmetic operations within this system, as well as writing larger numbers.

EXAMPLE 1

- a) Write the following numbers with Roman Numerals:
- (i) 36 (ii) 247 (ii) 3979



Microlecture Approach

The Beginning of Boolean Algebra

Around 1850, British mathematician, George Boole, developed a new form of mathematics known as Boolean Algebra. This algebra is one of the tools that are used in designing electron

From a Truth Table to a Boolean Expression

RT From a given truth table we can generate a K-map which can be further simplified to produce the simplest Boolean Expression in SOP (Sum of Product) form.

Each row in the truth table corresponds to a minterm. The sum of all minterms is the simplified (cost)

Exercise 1

Obtain the corresponding BE from the following Truth Table and simplify using K-Maps:

A	B	C	D	X
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

- ☐ $C + D + \bar{A}B$
- ☐ $AB + \bar{B}C + \bar{C}D$
- ☐ $C + \bar{D} + \bar{A}B\bar{C}$

After the Lecture

In grouping 1s, explain why we cannot loop three 1s in a row or a column?

Equation Editor

Styles Font Size

Words: 0

- Provide guided questions with increasing difficulties;
 - ✓ Not knowing is not a pleasant feeling.
- After the lecture:
 - ✓ Where do you think a student may make a mistake?
 - ✓ What do you think your teacher may ask on the test?



MATH10042

Mathematics for Computer Studies

with Frosina Stojanovska-Pocuca

Are your pencils sharpened?
Class is starting soon!



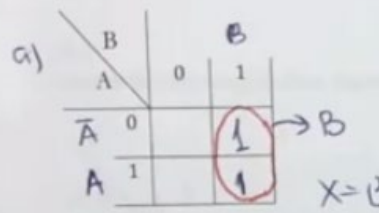
Music: <https://www.bensound.com>

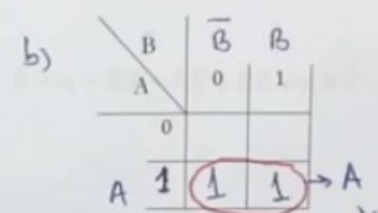
Online Classes

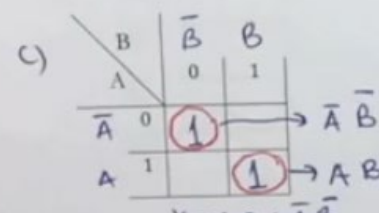
- ✓ Two 2-hour lectures;
- ✓ Microlecture;
- ✓ Same Worksheets;
- ✓ Document Camera;

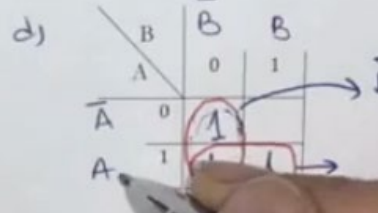
Ex. 5
Simplify the following Boolean Expressions using K-maps:

a) $X = \underline{AB} + \underline{\bar{A}B}$ b) $X = \underline{AB} + \underline{AB}$ c) $X = \underline{\bar{A}B} + \underline{AB}$ d) $X = \underline{AB} + \underline{\bar{A}B} + \underline{\bar{A}\bar{B}}$

a)  $X=B$

b)  $X=A$

c)  $X = \bar{A}\bar{B} + AB$

d)  $X = \bar{A}\bar{B} + AB$

1/2/4/8, ...
Least # of loops
biggest loop

2.2 Fall 2021

2.2

- 2.2 Simplification of Boolean Expressions ✓
- 2.2.1 Postulates, Properties and Theorems ✓
- 2.2.2 De Morgan's Theorem ✓
- 2.2.3 Absorption Theorems
- 2.2.4 Karnaugh Maps

Simplifying Example

By applying Boolean postulates, properties and/or theorems we can simplify complex Boolean expressions and build a smaller logic block diagram (less expensive circuit).

For example, to simplify $AB(A+C)$ we have:

$$AB(A+C) = ABA + ABC$$
$$= AAB + ABC$$

Remaining Time: Unlimited

distributive law

commutative law $ABA = AAB$

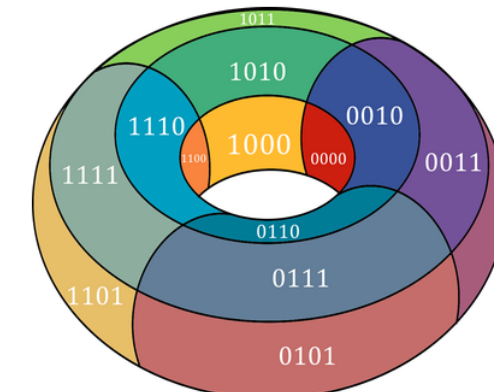
theorem 3a

distributive law

theorem 2b


theorem 2a

Note on Karnaugh Maps continued



ABCD			
0000	0100	1100	1000
0001	0101	1101	1001
0011	0111	1111	1011
0010	0110	1110	1010

A 3D 4-variable Karnaugh Map could be represented with a torus (donut shape).

Finished 

Slide 9 / 9

Save Quit & Save Previous Page Next Page

Online Classes

- ✓ Two 2-hour lectures;
- ✓ Microlecture;
- ✓ Same Worksheets;
- ✓ Document Camera;
- ✓ Chat;
- ✓ Polls;



<https://mathigon.org/timeline>

<http://radio.garden>

1. How is class going so far?

- ☐ I can follow along well.
- ☐ I have troubles with some of the questions.
- ☐ I have no clue what is going on...



Which of the following is true?

- ☐ All of the below
- ☐ None of the below
- ☐ All of the above
- ☐ One of the above
- ☐ None of the above
- ☐ None of the above



<https://www.amazon.ca/>

Brain Breaks

- ❑ A video insert from a talk given by Dylan Beattie at NDC London, 2020

“... Code created just to make people smile, laugh, or created just to see if it was possible?...”

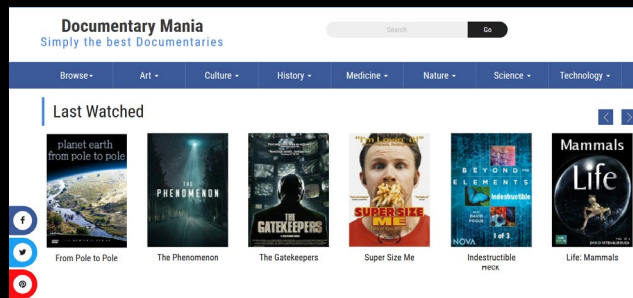


[The Art of Code – Dylan Beattie](http://www.youtube.com/watch?v=6avJHaC3C2U)

<http://www.youtube.com/watch?v=6avJHaC3C2U>

Brain Breaks

- ❑ A video clip from a movie presenting mathematics as a building block for their own program area;



[The Bit Player - Documentary Mania](http://www.documentarymania.com/player.php?title=The+Bit+Player)

<http://www.documentarymania.com/player.php?title=The+Bit+Player>

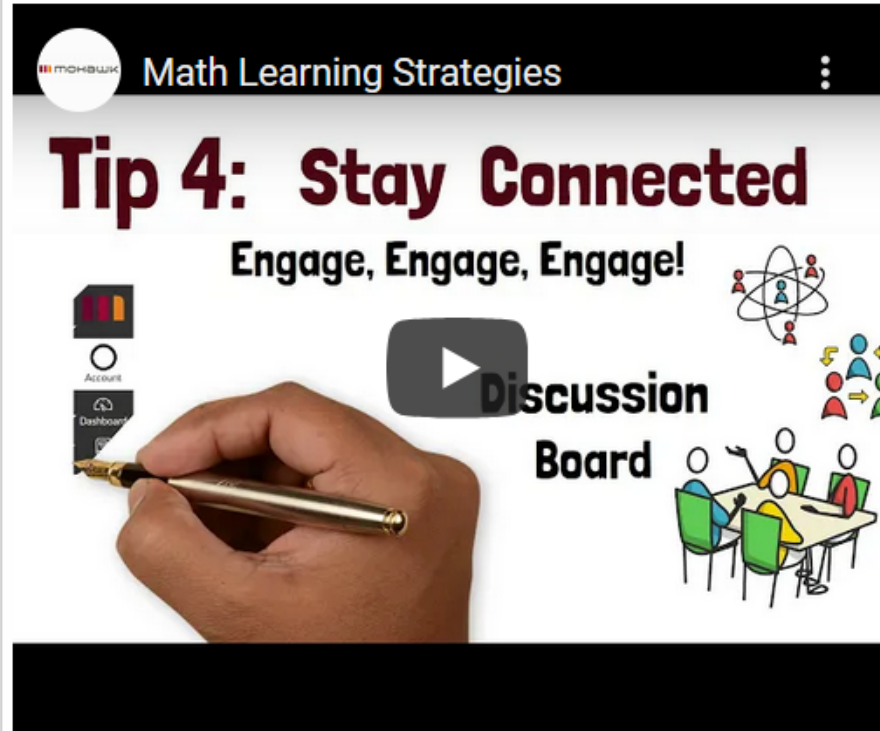
Learning Strategies

Included in an Assignment

- Identify some strategies that may be used.
- After Test 1 students are asked
 - ✓ If they used the strategies and if they helped;
 - ✓ Which steps can be taken going forward.

Example

Please watch the following video and answer the question below:



<https://www.youtube.com/watch?v=u5vYPaYmiTs>

Pick one or more study tips mentioned in the video and expand:

Which tip/s you will adopt for studying our math course?

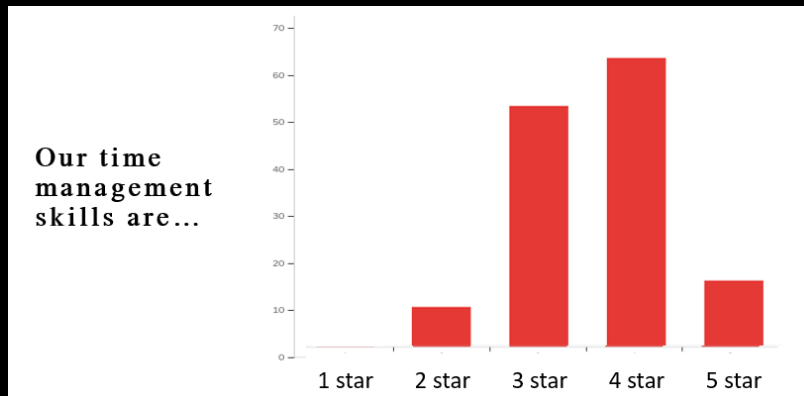
Rich text editor toolbar with icons for undo, redo, bold, italic, underline, strikethrough, text color, background color, link, unlink, list, indent, outdent, and a search icon. Below the toolbar are dropdown menus for Styles, Font, and Size. The main text area is empty.

Learning Strategies

□ Top 3:

1. Manage your Time
2. Master your Environment
3. Take Notes

9. Eliminate Distractions



□ After Test 1

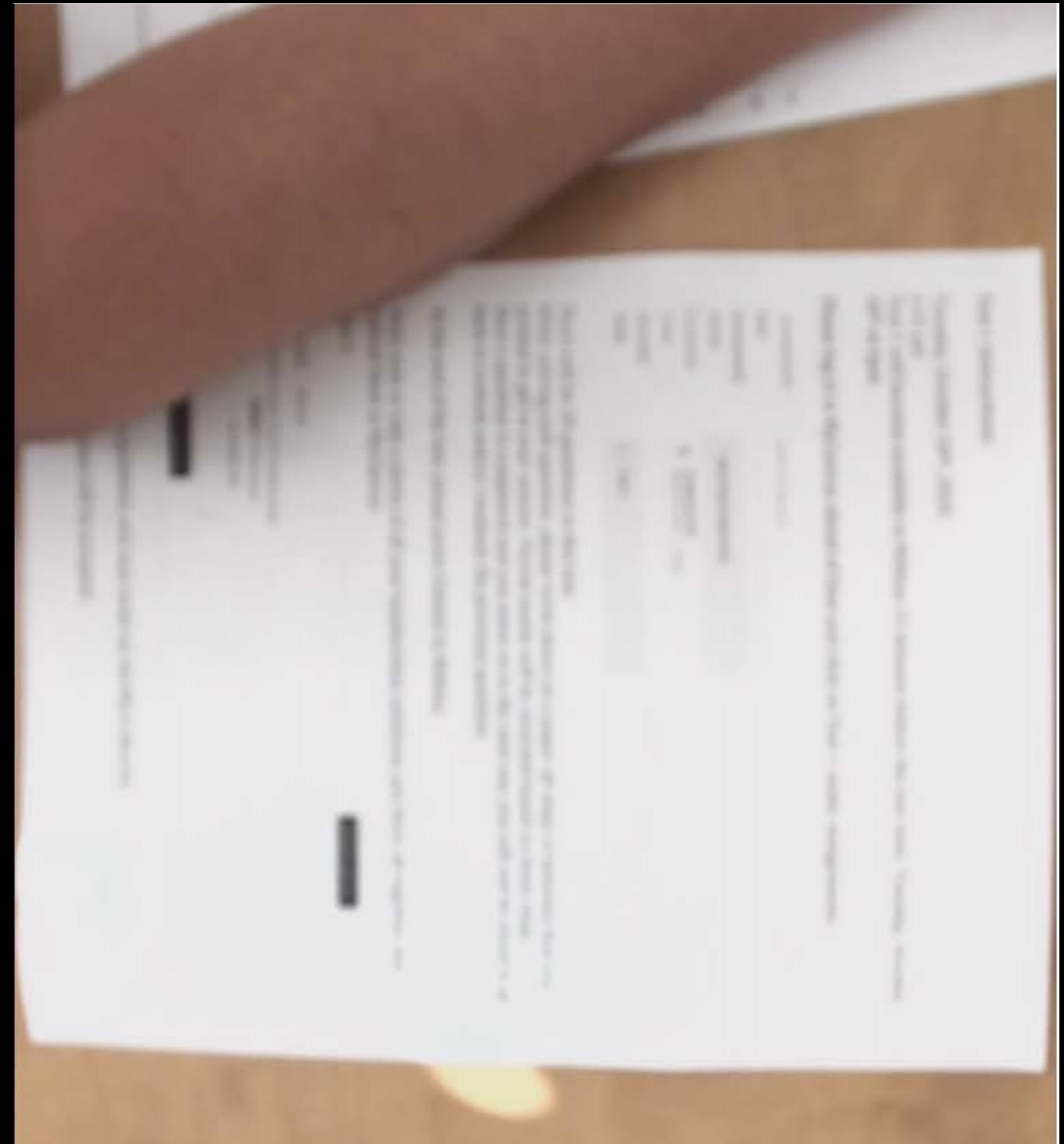
	Master the Environment	29%
3	Manage your Time	71%
	Assemble your Resources	69%
	Stay Connected	43%
	Demonstrate Self-Motivation	50%
1	Take Notes	93%
	Stay Healthy	58%
	Embrace the Failure	39%
2	Eliminate Distractions	78%
	Reward Yourself	41%

About Instructions

- ❑ Handwritten solutions were required to be uploaded to Dropbox

"...I posted a file with instructions on Test 1 under Assessments/Test1 in MyCanvas. Take a moment and review it before our class today and we can further discuss the test requirements and recommendations...."

Do I have to show all the steps?



About Assessments

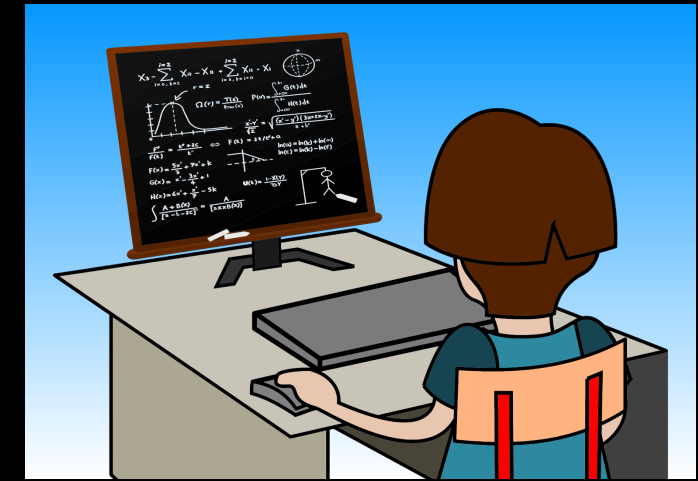
- ❑ What do we assess
and how do we asses?

“What and how students learn depends to a major extent on how they think they will be assessed.” - John Biggs

The long-term goal is to create healthier study habits with students where they recognize assessments as important learning opportunities.

❑ Poll 1:

- ✓ Discussions;
- ✓ Quizzes;
- ✓ Assignments;
- ✓ Tests/Exams;
- ✓ Oral Assessments;
- ✓ Proctored Assessments;
- ✓ Open Book Assessments;
- ✓ Group Work;
- ✓ Lab Reports/Research Projects;
- ✓ Video/In-person Presentations;



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Quizzes

- ❑ SAE – Short Answer with Explanation
- ❑ MCE – Multiple Choice with Explanation

- ✓ Students need to articulate why they chose the method to solve given problem in a certain way or what the solution means in the context.

Write the following numbers as indicated:

- Question 4

a) 3394 = 1 point

b) CCCXC

Describe the

A new laser printer prints 160 % faster than the current printer which prints ten pages per minute. How many pages per minute does the new printer print?

The number of pages per minute the new printer prints is:

- ☐ 25 pages
- ☐ 23 pages
- ☐ 31 pages
- ☐ 28 pages
- ☒ 26 pages

Penalty: 0.1 per incorrect attempt

Well Done!
That is a great Printer.
Next

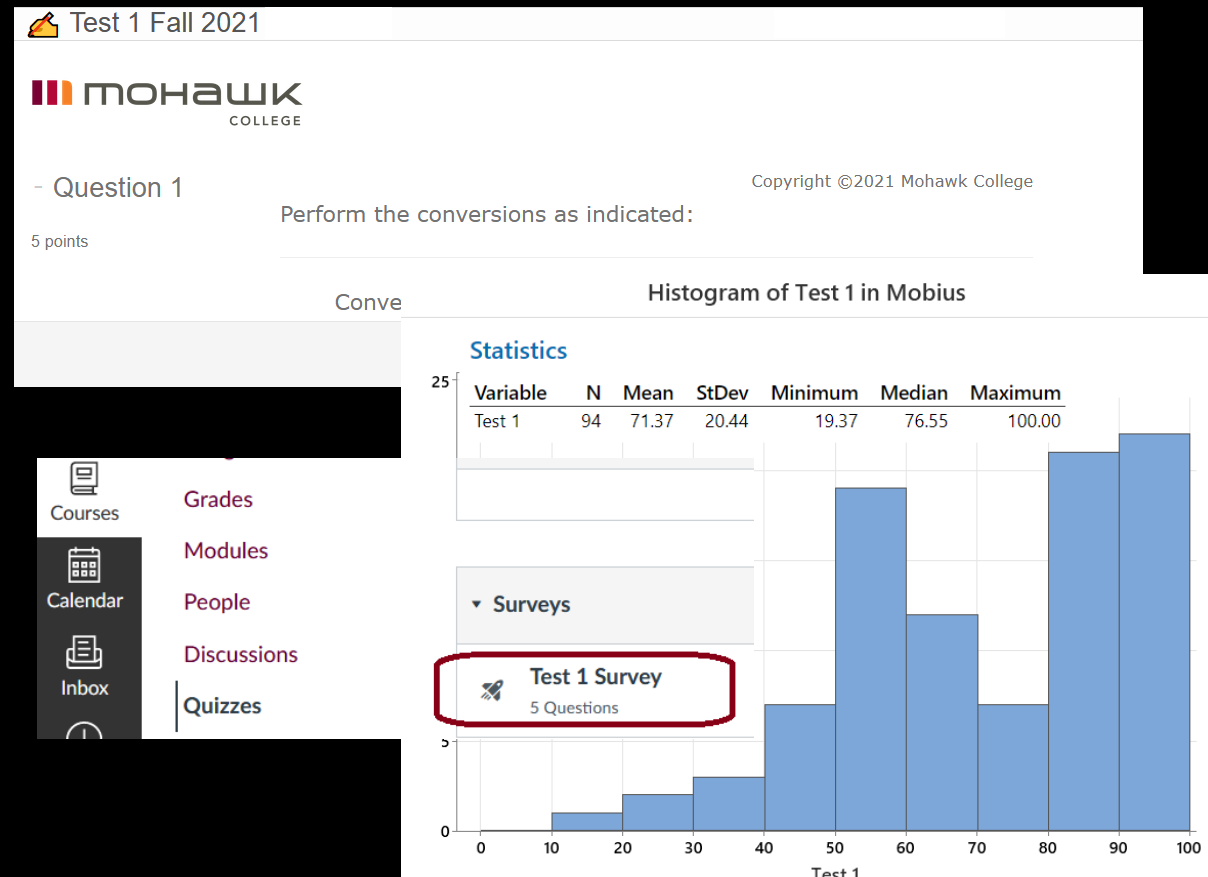
IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT®)
Name _____ Test # _____
Subject _____ Total _____
SCRATCH OFF COVERING TO EXPOSE ANSWER

	A	B	C	D	E	Score
1.		*				
2.					*	
3.			*			
4.	*					
5.			*			

U.S. Patent No. 6,210,171

Tests

- ❑ Students like the feeling when they are given a chance to have an input.
- ❑ Communicate the Results



möbius

Student Name	Q	G	Response
student 1	1	0	multi:list%3a%2c,list%3a%2c,list%3a%2c,string%3a
student 2	1	1	multi:list%3a539%2c1,list%3a1576%2c1,list%3a2903%2c1,string%3a3 %26%239734 %26%239734 %26%239734
student 3	1	0	multi:list%3a%2c,list%3a%2c,list%3a%2c,string%3a
student 4	1	1	multi:list%3a608%2c1,list%3a1270%2c1,list%3a2579%2c1,string%3a5 %26%239734 %26%239734 %26%239734 %26%239734
student 5	1	1	multi:list%3a806%2c1,list%3a1356%2c1,list%3a2272%2c1,string%3a5 %26%239734 %26%239734 %26%239734 %26%239734
student 6	1	1	multi:list%3a661%2c1,list%3a1717%2c1,list%3a2992%2c1,string%3a5 %26%239734 %26%239734 %26%239734 %26%239734
student 7	1	1	multi:list%3a453%2c1,list%3a1896%2c1,list%3
student 8	1	1	multi:list%3a854%2c1,list%3a1543%2c1,list%3
student 9	1	0	multi:list%3a%2c,list%3a%2c,list%3a%2c,string%3a
student 10	1	1	multi:list%3a325%2c1,list%3a1254%2c1,list%3
student 11	1	1	multi:list%3a263%2c1,list%3a1717%2c1,list%3
student 12	1	1	multi:list%3a211%2c1,list%3a1655%2c1,list%3
student 13	1	1	multi:list%3a210%2c1,list%3a1349%2c1,list%3
student 14	1	1	multi:list%3a872%2c1,list%3a1957%2c1,list%3

	A	B	C	D
1 question	1	2	3	
2 5 star	24	24	16	
3 4 star	3	6	6	
4 3 star	1	0	4	
5 2 star	0	2	1	
6 1 star	1	0	2	
7 total	29	32	29	

Showing 5-card poker hand:
for cards of equal but different

Please rate this question in order of preference (and your understanding) for the test:

How To...?



Read comments and feedback on test papers.

OK

Delete

<http://atom.smasher.org/error>

Click for List

5 ★ ★ ★ ★ ★

4 ★ ★ ★ ★

3 ★ ★ ★

2 ★ ★

1 ★

- ✓ Read the comments and predict your grade
- ✓ Describe any changes in strategies
- ✓ Top 3: 1. Take Notes
2. Eliminate Distractions
3. Manage your Time;

Errors, Feedback and Intrigue

Example

In the following example a common mistake has been made.

Highlight the line where the wrong step was made and describe it. Then, solve the equation properly and provide the correct value for the unknown.

$$5 - 3(4x - 7) = -6x$$

$$2(4x - 7) = -6x$$

$$8x - 14 = -6x$$

$$8x + 6x = 14$$

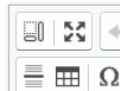
$$14x = 14$$

$$x = \frac{14}{14}$$

$$x = 1$$

Correct value

Describe the error



Question 1

1 point

How Did I Do?

Remaining "How Did I Do?" Uses: 2/3

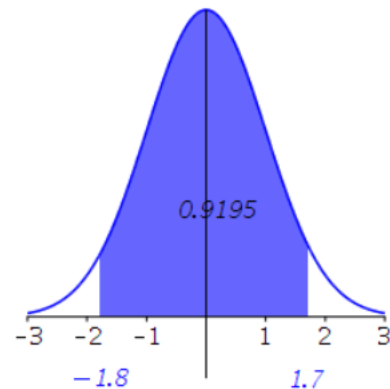
Suppose the random variable Z follows a standard normal distribution. Calculate the area between -1.8 and 1.7 .

$$P(-1.8 < Z < 1.7) = \text{Number}$$

(round your answers to 4 decimal places)

Feedback

To find $P(-1.8 < Z < 1.7)$, we need to find the difference in areas under a standard normal curve to the left of 1.7 and -1.8 . Using computer software, or approximating with a table, we can find this area to be 0.919504 . Graphically this is as:



Example

Please watch the following video and then answer the question below:



Are there any grounds for appeal? Please explain.

(Were there any mistakes made in solving the equation? Would there be any other valid answers for x ?)

Rich text editor toolbar with icons for bold, italic, underline, strikethrough, text color, background color, bulleted list, numbered list, link, unlink, and search.

Equation Editor

Styles Font Size

Words: 0

Grade

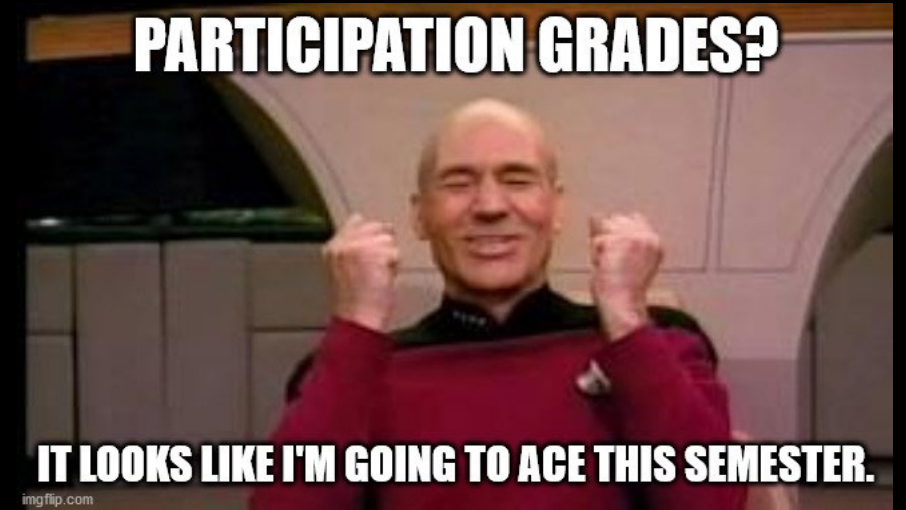
Close

Participation

What goes in this grade?

❑ Poll 2

- ✓ attendance to online/in-class lectures/tutorials;
- ✓ online/in-class quizzes;
- ✓ online/in-class whole-class or small group discussions;
- ✓ timely completion of assigned out-of-class work;
- ✓ LMS discussion boards;
- ✓ no participation should be graded;



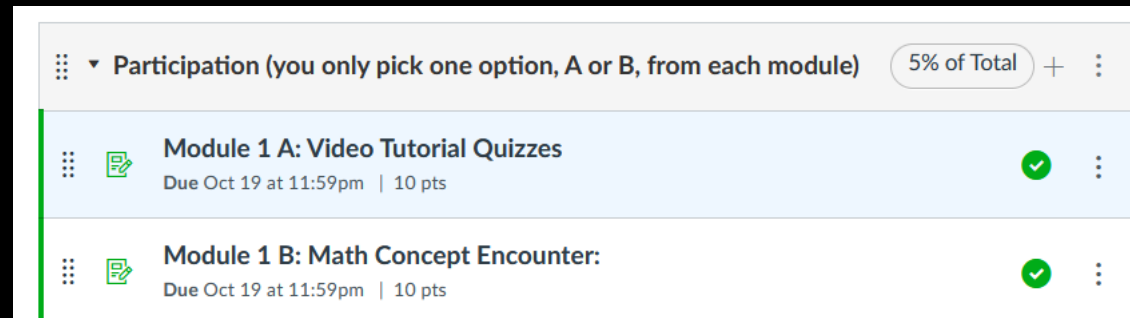
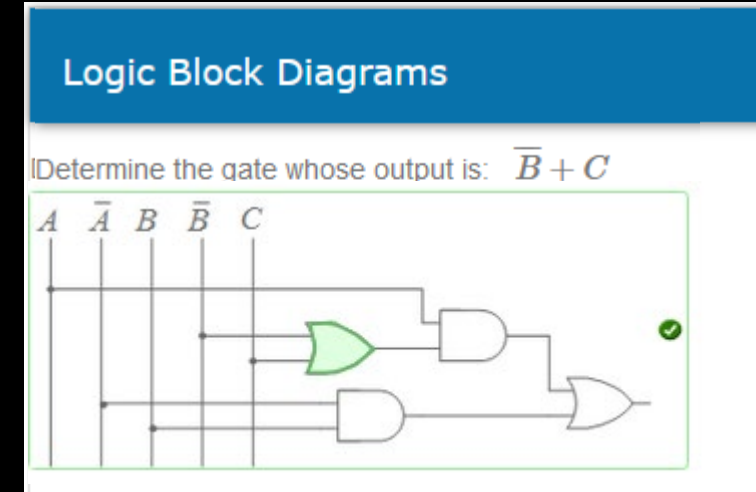
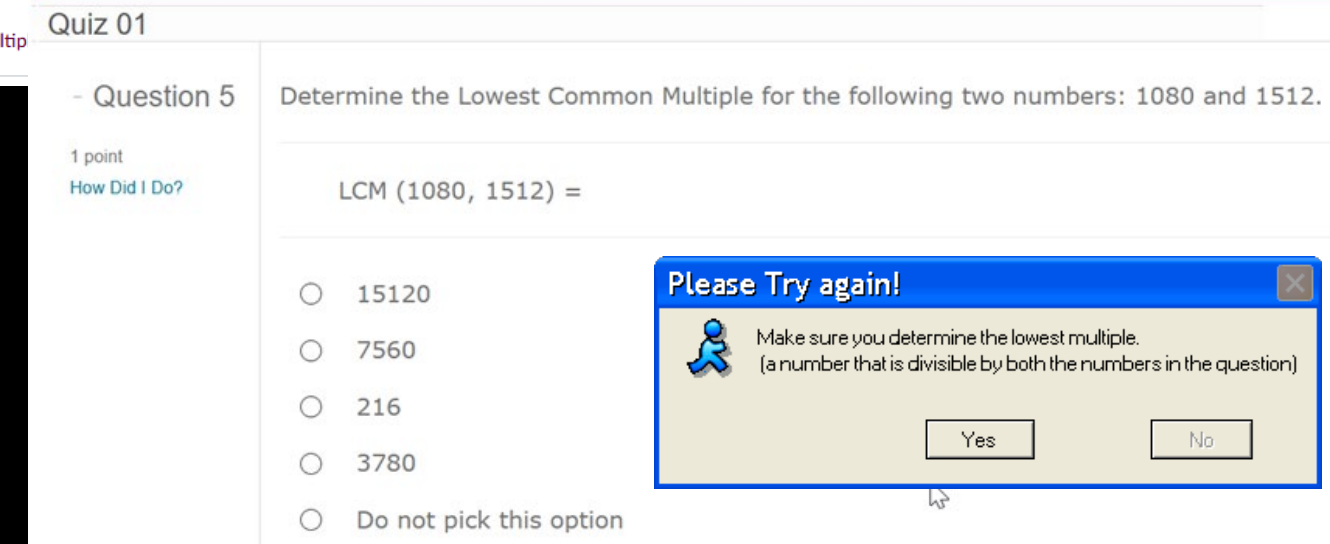
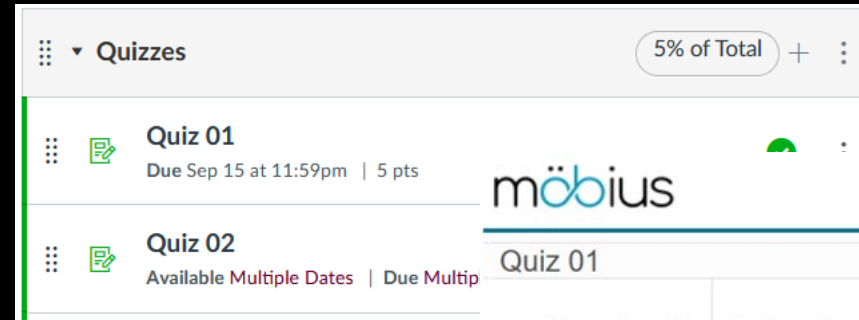
<https://imgflip.com/memegenerator>

Participation

▣ Quizzes - online;

▣ Participation A or B:

- ✓ Video Tutorial Quizzes;
- ✓ Math Concept Encounter;



Participation

- ❑ Video Tutorial Quizzes;
- ✓ Watch a math video on particular topic;
- ✓ Complete an online quiz;
- ✓ Each of the quizzes contains multiple choice questions about the topic explained in the video.
- ✓ Full solutions required for 1 or 2 questions.

M2 Video Tutorial Quiz

- Question 6

0 point

Mode of Affirming

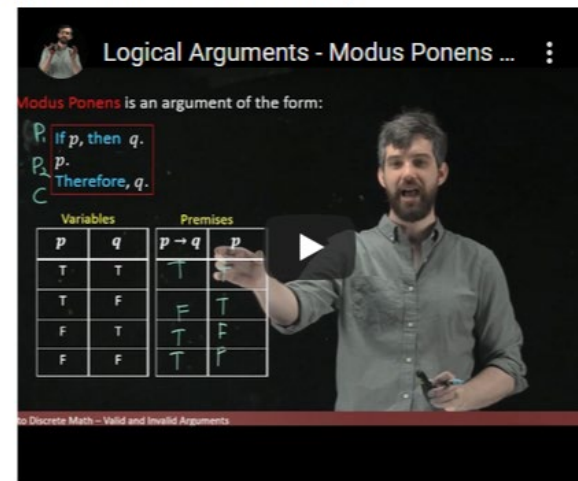
The mode of Affirming by affirmation (Modus Ponens) is one of the standard rules of inference. It is used in a form of a chain of two premises in order to achieve the conclusion.

The first premise is a conditional (if A then B) claim,

The second premise is an assertion that the antecedent A happened.

And the conclusion follows that the consequent B happens as well.

The following video provides additional information on Modus Ponens (the first 6:25 of the full 8:45).



Submit Assignment

Quit & Save

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Question Menu

Next

M2 Video Tutorial Quiz

Remaining Time: Unlimited

- Question 2

Remaining Time: Unlimited

Artificial Intelligence

Artificial Intelligence (AI) aims to develop smart machines that will be able to behave in a way that could be characterized as intelligent. Many of these processes are powered by systems of mathematical logic, particularly formal logic, as they need to produce results that makes sense to a computer program.

The following video illustrates an example of logic performed by a system using the OpenCog system, which is a diverse assemblage of various algorithms.



Remaining Time: Unlimited

Determine the validity of the two arguments (A, and B) below:
(If True, explain the conclusion in your own words.)
(If False, provide a counterexample.)

Argument A:

If I take the bus I will get there quicker;

I have not taken the bus;

∴ Therefore, I did not get

Click for List

Explain/Counterexample:

this part will be graded after submission;

Submit Assignment

Quit & Save

Back

Question Menu

Next

Participation

- ❑ Math Concept Encounter;
- ✓ Pick a concept that you had problems understanding
- ✓ Provide details on why this concept was challenging and how you came to understand the concept
- ✓ Reflect and share what strategies helped improve your learning

INTRODUCTION

I struggled with m
binary numbers as
numbers were so l
would lose track o
was. Especially wh

SOLUTION OF Ex. 1

Circling double ones
to ensure carryovers
(Strategy)

Organization

Staying organized by
putting placeholders so
that
d just
ation

J. M.

SOLUTION OF Ex. 2

De Morgan's Law

Single Variable

Counting In Binary, Octal, and Hexadecimal Number Systems

0, 1, 10, 11, 100, 101, 110

P. G.

Conclusion

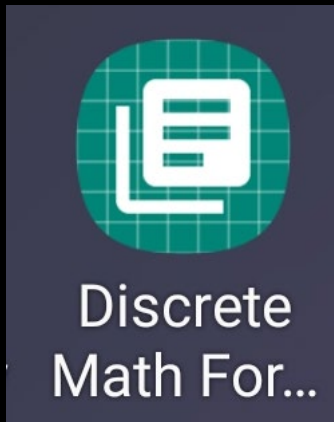
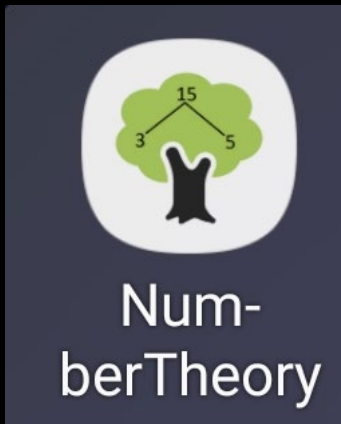
Strategies that helped improve my learning

- Doing practice problems repeatedly to reinforce the idea
- Watching videos after the lecture to help understand the concept
- Asking for help when I was not clear
- Organization of the numbers with neat writing so I do not divide the same number again.

Jasmeet. M.

Students' work...

Students love sharing their accomplishments



```
*SIN-UPC-ISBN-Validator.py -
File Edit Format View Help
# prog
# auth

TypeAndExecute
File Edit
#Sets i
#Count
#e.g. "
temp=in
s=temp.
print(s

#
# i=0
# count=0
while T
and a    if(

    if(

        i=i
        print("

Enter the number with
missing digits as x and

*Aidan_sig_digs.py - Notepad
File Edit
#file nam
#author

*CheckDigit Charlie.py - Notepad
File Edit Format View Help
# I, ZR, student number ###, certify that all code submitted is my own work;
#that I have not copied it from any other source.  I also certify that I have
#not allowed my work to be copied by others.

def SIN(num):
    if(num[8].isalpha()):
        a0 = int(num[0])
        a1 = int(num[1]) * 2
        if(len(str(a1)) == 2):
            a1 = str(a1)
            a1 = int(a1[0]) + int (a1[1])
        a2 = int(num[2])
        a3 = int(num[3]) * 2
        if(len(str(a3)) == 2):
            a3 = str(a3)
            a3 = int(a3[0]) + int (a3[1])
        a4 = int(num[4])
        a5 = int(num[5]) * 2
        if(len(str(a5)) == 2):
            a5 = str(a5)
            a5 = int(a5[0]) + int (a5[1])
        a6 = int(num[6])
```



Tournament Scheduling

Gamifying the Experience

- ❑ How gamification can increase student persistence and engagement?
 - ✓ motivated
 - ✓ awards and instant results
 - ✓ increased self confidence
 - ✓ encouraged not to be afraid to fail
 - ✓ establish team work skills
 - ✓ may guide students through the material



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Mat



MER ideas: Professor Paul McGrath, U of Waterloo
360 Images: Professor Richard Borger, Mohawk College

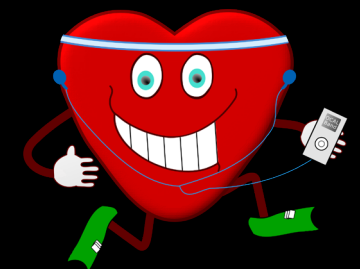
At the end...

Ideas come in strangest ways...

- Our time is finite: focus on a few things at a time and then build upon every semester
- Surround yourself with colleagues that inspire you
- Add your own self care to any ToDo list



I math, therefore I am!



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- What a year it has been, indeed!

What's next?

Questions & Inquires

Thank you!