


Course Outline	
MATH6025 Discrete Mathematics (4)	
Effective Date 01 September 2017	Study Program Mathematics Revision 2

1. Course Description

This course provides basic concepts of logic and discrete mathematics. Topics included are the logic of compound and quantified statements, some methods of proof, counting including permutations and combinations, number theory. Besides that, this courses studying about set theory, number theory function, recursion, fuzzy set, relations, graphs and finite automata. This course supports the other courses related with mathematical problem solving, computer science, and programming logic. On the other side, by this course students will develop the reasoning power to analyze discrete problems

2. Graduate Competency

Each course in the study program contributes to the graduate competencies that are divided into employability and entrepreneurial skills and study program specific outcomes, in which students need to have demonstrated by the time they complete their course.

BINUS University employability and entrepreneurial skills consist of planning and organizing, problem solving and decision making, self management, team work, communication, and initiative and enterprise.

2.1. Employability and Entrepreneurial Skills

Aspect	Key Behaviour

2.2. Study Program Specific Outcomes

Study Program Specific Outcomes
(SO-1) - Able to create software application design with the implementation of database system principal design to solve structured and semi-structured data

3. Topics

- The logic of compound statements part 1
- The logic of compound statements part 2
- The logic of quantified statements
- Methods of proof
- Counting
- Set Theory
- Number Theory
- Function, recursion, and fuzzy set
- Relations
- Graph Theory
- Trees
- Graph Applications
- Finite Automata

4. Learning Outcomes

On successful completion of this course, student will be able to:

- LO 1: Evaluate the logic of compound and quantified statements and how do to proof
- LO 2: Explain Set Theory, Counting method and Number Theory
- LO 3: Explain Function, recursion, fuzzy set, Relations and Graph Theory
- LO 4: Explain Trees & Graph theory and its application
- LO 5: Explain Automata and graph its application in computer science

5. Teaching And Learning Strategies

In this course, the lecturers might deploy several teaching learning strategies, including Discussion, Lecture, Individual and Team Assignment, Demonstrate problem-solving through case studies, and Problem Solving.

6. Textbooks and Other Resources

6.1 Textbooks

1. Susanna S. Epp. (2011). *Discrete mathematics with applications*. 04. Brooks/Cole Publishing. Boston. ISBN: 9780495391326.

The book in the first list is a must to have for each student.

6.2 Other Resources

1. <http://www.cs.nthu.edu.tw/~cchen/CS4351/ch3.ppt>
2. <http://www.cs.kent.edu/~jbaker/Discrete-Sp11/./Inroduction.ppt>
3. <http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/15251-f08/Site/Materials/Lectures/Lecture20/lecture20-handout.pdf>
4. Discrete Mathematics
5. <http://www.maths.manchester.ac.uk/~mdc/old/1K1/notes07.pdf>
6. <http://www.personal.kent.edu/~rmuhamma/GraphTheory/MyGraphTheory/trees.htm>
7. <http://www.utm.edu/departments/math/graph/>
8. <http://www.mathsisfun.com/combinatorics/combinations-permutations.html>
9. <http://www.math.hmc.edu/funfacts/ffiles/20009.5.shtml>
10. <http://www.efunda.com/math/settheory/settheory.cfm>
11. <http://www.sparknotes.com/math/algebra2/functions/section1.html>
12. <http://www.mathwarehouse.com/algebra/relation/math-function.php>
13. <http://www.ee.surrey.ac.uk/Projects/Labview/boolalgebra/index.html>
14. http://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/sbaa/report.fuzzysets.html
15. <http://www.mathsisfun.com/algebra/binomial-theorem.html>
16. <http://www.tutors4you.com/permutationcombinationtutorial.htm>
17. <http://mathworld.wolfram.com/DirectedGraph.html>
18. <http://www.purplemath.com/modules/binomial.htm>
19. <http://www.sjsu.edu/faculty/watkins/fuzzysets.htm>
20. <http://www.austinlinks.com/Fuzzy/overview.html>
21. <http://www.facstaff.bucknell.edu/mastascu/eLessonsHTML/Logic/Logic3.html>
22. <http://www.ijest.info/docs/IJEST10-02-09-124.pdf>
23. <http://www.csee.umbc.edu/~artola/fall02/Number theory.ppt>
24. http://www.richardclegg.org/networks2/Lecture11_06.pdf

7. Schedule

Theory

Session/ Mode	Related LO	Topics	References
1 F2F	LO 1	The logic of compound statements part 1 - Logical form and logical equivalence - Conditional statements - Valid and invalid arguments - Fuzzy logic	- The logic of compound statements - Discrete mathematics with applications, Chapter 1 - Boolean Algebra, http://www.ee.surrey.ac.uk/Projects/Labview/boolalgebra/index.html - Fuzzy Logic: The Logic of Fuzzy Sets,

			http://www.sjsu.edu/faculty/watkins/fuzzysets.htm
2 F2F	LO 1	The logic of compound statements part 1 - Logical form and logical equivalence - Conditional statements - Valid and invalid arguments - Fuzzy logic	- The logic of compound statements - Discrete mathematics with applications, Chapter 1 - Boolean Algebra, http://www.ee.surrey.ac.uk/Projects/Labview/boolalgebra/index.html - Fuzzy Logic: The Logic of Fuzzy Sets, http://www.sjsu.edu/faculty/watkins/fuzzysets.htm
3 F2F	LO 1	The logic of compound statements part 2 - Digital logic circuits - Disjunction Normal Form - Karnaugh map	- The logic of compound statements part 2 - Discrete mathematics with applications, Logic compound statement 2 - Logic compound statement, http://www.facstaff.bucknell.edu/mastascu/eLessonsHTML/Logic/Logic3.html
4 F2F	LO 1	The logic of compound statements part 2 - Digital logic circuits - Disjunction Normal Form - Karnaugh map	- The logic of compound statements part 2 - Discrete mathematics with applications, Logic compound statement 2 - Logic compound statement, http://www.facstaff.bucknell.edu/mastascu/eLessonsHTML/Logic/Logic3.html
5 GSLC	LO 1	The logic of quantified statements - Introduction to predicates and quantified statements - Statements containing multiple quantifiers	- The logic of quantified statements - Discrete mathematics with applications, chapter 2 - Quantifiers and quantified arguments, http://www.maths.manchester.ac.uk/~mdc/old/1K1/notes07.pdf
6 GSLC	LO 1	The logic of quantified statements - Introduction to predicates and quantified statements - Statements containing multiple quantifiers	- The logic of quantified statements - Discrete mathematics with applications, chapter 2 - Quantifiers and quantified arguments, http://www.maths.manchester.ac.uk/~mdc/old/1K1/notes07.pdf
7 F2F	LO 1	Methods of proof - Direct proof and counterexample - Mathematical induction	- Methods of proof - Discrete mathematics with applications, Chapter 3-4 - Mathematical induction, http://www.math.hmc.edu/funfacts/ffiles/20009.5.shtml
8 F2F	LO 2	Counting - Introduction - Multiplication Rule and Addition Rule - Permutation and Combinations	- Counting - Discrete mathematics with applications, Chapter 6 - Combination-Permutation,

		- The Binomial Theorem	http://www.mathsisfun.com/combinatorics/combinations-permutations.html - Binomial Theorem, http://www.mathsisfun.com/algebra/binomial-theorem.html - Permutation and Combination, http://www.tutors4you.com/permutationcombinationtutorial.htm - The Binomial Theorem: Formulas, http://www.purplemath.com/modules/binomial.htm
9 F2F	LO 2	Counting - Introduction - Multiplication Rule and Addition Rule - Permutation and Combinations - The Binomial Theorem	- Counting - Discrete mathematics with applications, Chapter 6 - Combination-Permutation, http://www.mathsisfun.com/combinatorics/combinations-permutations.html - Binomial Theorem, http://www.mathsisfun.com/algebra/binomial-theorem.html - Permutation and Combination, http://www.tutors4you.com/permutationcombinationtutorial.htm - The Binomial Theorem: Formulas, http://www.purplemath.com/modules/binomial.htm
10 F2F	LO 2	Set Theory - Properties of set - Boolean algebra	- Set Theory - Discrete mathematics with applications, chapter 5 - Set Theory, http://www.efunda.com/math/settheory/settheory.cfm
11 F2F	LO 2	Number Theory - Divisors - Primer Factorization - Congruence - Quadratic Residues	- Number Theory - Discrete mathematics with applications, Chapter 4 - Number Theory, http://www.cs.nthu.edu.tw/~cchen/CS4351/ch3.ppt - Introduction to Number Theory, http://www.csee.umbc.edu/~artola/fall02/Numbertheory.ppt
12 F2F	LO 2	Number Theory - Divisors - Primer Factorization - Congruence - Quadratic Residues	- Number Theory - Discrete mathematics with applications, Chapter 4 - Number Theory, http://www.cs.nthu.edu.tw/~cchen/CS4351/ch3.ppt - Introduction to Number Theory, http://www.csee.umbc.edu/~

			artola/fall02/Number theory.ppt
13 F2F	LO 3	Function, recursion, and fuzzy set - Definition of function - Inverse function - Recursion - Definition of fuzzy set - Properties of fuzzy set	- Function, recursion, and fuzzy set - Discrete mathematics with applications, Chapter 7-8 - Function, http://www.mathwarehouse.com/algebra/relation/math-function.php - Fuzzy set and Operations, http://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/sbaa/report.fuzzysets.html - Fuzzy Logic Overview, http://www.austinlinks.com/Fuzzy/overview.html
14 F2F	LO 3	Function, recursion, and fuzzy set - Definition of function - Inverse function - Recursion - Definition of fuzzy set - Properties of fuzzy set	- Function, recursion, and fuzzy set - Discrete mathematics with applications, Chapter 7-8 - Function, http://www.mathwarehouse.com/algebra/relation/math-function.php - Fuzzy set and Operations, http://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/sbaa/report.fuzzysets.html - Fuzzy Logic Overview, http://www.austinlinks.com/Fuzzy/overview.html
15 GSLC	LO 3	Relations - Reflexivity, Symmetry and Transitivity - Equivalence Relations - Partial Order Relations	- Relations - Discrete mathematics with applications, Chapter 10 - Relations and Function, http://www.sparknotes.com/math/algebra2/functions/section1.html
16 GSLC	LO 3	Relations - Reflexivity, Symmetry and Transitivity - Equivalence Relations - Partial Order Relations	- Relations - Discrete mathematics with applications, Chapter 10 - Relations and Function, http://www.sparknotes.com/math/algebra2/functions/section1.html
17 F2F	LO 4	Graph Theory - Introduction - Paths and Circuits - Matrix Representations of Graphs - Isomorphism of Graphs - Graphs Coloring	- Graph Theory - Discrete mathematics with applications, Chapter 11 - Graph Theory Tutorial, http://www.utm.edu/departments/math/graph/ - Discrete Mathematics - Directed Graph, http://mathworld.wolfram.com/DirectedGraph.html - Basic Graph Theory, http://www.richardclegg.org/networks2/Lecture11_06.pdf

18 F2F	LO 4	<p>Graph Theory</p> <ul style="list-style-type: none"> - Introduction - Paths and Circuits - Matrix Representations of Graphs - Isomorphism of Graphs - Graphs Coloring 	<ul style="list-style-type: none"> - Graph Theory - Discrete mathematics with applications, Chapter 11 - Graph Theory Tutorial, http://www.utm.edu/departments/math/graph/ - Discrete Mathematics - Directed Graph, http://mathworld.wolfram.com/DirectedGraph.html - Basic Graph Theory, http://www.richardclegg.org/networks2/Lecture11_06.pdf
19 F2F	LO 4	<p>Graph Theory</p> <ul style="list-style-type: none"> - Introduction - Paths and Circuits - Matrix Representations of Graphs - Isomorphism of Graphs - Graphs Coloring 	<ul style="list-style-type: none"> - Graph Theory - Discrete mathematics with applications, Chapter 11 - Graph Theory Tutorial, http://www.utm.edu/departments/math/graph/ - Discrete Mathematics - Directed Graph, http://mathworld.wolfram.com/DirectedGraph.html - Basic Graph Theory, http://www.richardclegg.org/networks2/Lecture11_06.pdf
20 F2F	LO 4	<p>Graph Theory</p> <ul style="list-style-type: none"> - Introduction - Paths and Circuits - Matrix Representations of Graphs - Isomorphism of Graphs - Graphs Coloring 	<ul style="list-style-type: none"> - Graph Theory - Discrete mathematics with applications, Chapter 11 - Graph Theory Tutorial, http://www.utm.edu/departments/math/graph/ - Discrete Mathematics - Directed Graph, http://mathworld.wolfram.com/DirectedGraph.html - Basic Graph Theory, http://www.richardclegg.org/networks2/Lecture11_06.pdf
21 GSLC	LO 4	<p>Trees</p> <ul style="list-style-type: none"> - Defintion of Trees - Rooted Tree - Spanning Tree and shortest paths - Minimum sapnning Trees 	<ul style="list-style-type: none"> - Trees - Discrete mathematics with applications, Chapter 11 - Trees, http://www.personal.kent.edu/~rmuhamma/GraphTheory/MyGraphTheory/trees.htm
22 GSLC	LO 4	<p>Trees</p> <ul style="list-style-type: none"> - Defintion of Trees - Rooted Tree - Spanning Tree and shortest paths - Minimum sapnning Trees 	<ul style="list-style-type: none"> - Trees - Discrete mathematics with applications, Chapter 11 - Trees, http://www.personal.kent.edu/~rmuhamma/GraphTheory/MyGraphTheory/trees.htm
23 F2F	LO 5	<p>Graph Applications</p> <ul style="list-style-type: none"> - Shortest path problem - Travelling saleman problem - Assigment problem - Application in Computer Science 	<ul style="list-style-type: none"> - Graph Applications - Discrete mathematics with applications, Chapter 12 - Application in computer science, http://www.cs.kent.edu/~jbaker/Discrete-

			Sp11../Inroduction.ppt - Application of Graph theory in Computer Science an overview, http://www.ijest.info/docs/IJEST10-02-09-124.pdf
24 F2F	LO 5	Graph Applications - Shortest path problem - Travelling salesman problem - Assignment problem - Application in Computer Science	- Graph Applications - Discrete mathematics with applications, Chapter 12 - Application in computer science, http://www.cs.kent.edu/~jbaker/Discrete-Sp11../Inroduction.ppt - Application of Graph theory in Computer Science an overview, http://www.ijest.info/docs/IJEST10-02-09-124.pdf
25 F2F	LO 5	Finite Automata - Introduction - Deterministic Finite Automata - Non deterministic Finite Automata	- Finite Automata - Discrete mathematics with applications, Chapter 13 - Deterministic Finite Automata, http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/15251-f08/Site/Materials/Lectures/Lecture20/lecture20-handout.pdf
26 F2F	LO 5	Finite Automata - Introduction - Deterministic Finite Automata - Non deterministic Finite Automata	- Finite Automata - Discrete mathematics with applications, Chapter 13 - Deterministic Finite Automata, http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/15251-f08/Site/Materials/Lectures/Lecture20/lecture20-handout.pdf

8. Evaluation

Theory

Assessment Activity	Weight	Learning Outcomes				
		1	2	3	4	5
Assignment	25%	√	√	√	√	√
Mid Exam	35%	√	√	√		
Final Exam	40%			√	√	√

Practicum

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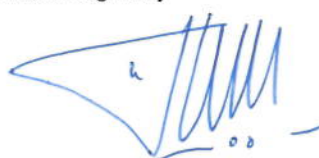
Final Evaluation Score

Aspects	Weight
Theory	100%
Practicum	0%

9. A. Assessment Rubric (Study Program Specific Outcomes)

LO	Indicators	Proficiency Level			
		Excellent (85 – 100)	Good (75 – 84)	Average (65 – 74)	Poor (<= 64)
LO 1	1.1. Student's is able to explain the logic of compound statements	Student's explanation is fully correct and the interpretation are clearly stated	Student's explanation is mostly correct with minor error and the interpretation are well stated	Student's explanation is fairly correct with some errors and the interpretation are less appropriate	Student's explanation is incorrect and the interpretation are inappropriate
	1.2. Student's is able to explain the logic of quantified statements	Student's explanation is fully correct and the interpretation are clearly stated	Student's explanation is mostly correct with minor error and the interpretation are well stated	Student's explanation is fairly correct with some errors and the interpretation are less appropriate	Student's explanation is incorrect and the interpretation are inappropriate
LO 2	2.1. Student's is able to explain the counting method and number theory and set theory	Student's explanation is fully correct and the interpretation are clearly stated	Student's explanation is mostly correct with minor error and the interpretation are well stated	Student's explanation is fairly correct with some errors and the interpretation are less appropriate	Student's explanation is incorrect and the interpretation are inappropriate
	2.2. Student's is able to explain application of counting method number theory and set theory	Application is fully correct and the interpretation are clearly stated	Application is mostly correct with minor error and the interpretation are well stated	Application is fairly correct with some errors and the interpretation are less appropriate	Application is incorrect and the interpretation are inappropriate
LO 3	3.1. Student's is able to explain the function, relation and fuzzy set.	Student's explanation is fully correct and the interpretation are clearly stated	Student's explanation is mostly correct with minor error and the interpretation are well stated	Student's explanation is fairly correct with some errors and the interpretation are less appropriate	Student's explanation is incorrect and the interpretation are inappropriate
	3.2. Student's is able to explain application of function, relation and fuzzy set.	Application is fully correct and the interpretation are clearly stated	Application is mostly correct with minor error and the interpretation are well stated	Application is fairly correct with some errors and the interpretation are less appropriate	Application is incorrect and the interpretation are inappropriate
LO 4	4.1. Student's is able to explain the Graph theory and Trees	Student's explanation is fully correct and	Student's explanation is mostly correct with	Student's explanation is fairly correct with	Student's explanation is incorrect and the

		the interpretation are clearly stated	minor error and the interpretation are well stated	some errors and the interpretation are less appropriate	interpretation are inappropriate
	4.2. Student's is able to explain application of Graph theory and Trees	Application is fully correct and the interpretation are clearly stated	Application is mostly correct with minor error and the interpretation are well stated	Application is fairly correct with some errors and the interpretation are less appropriate	Application is incorrect and the interpretation are inappropriate
LO 5	5.1. Student's is able to explain finite automata and graph theory in computer science.	Student's explanation is fully correct and the interpretation are clearly stated	Student's explanation is mostly correct with minor error and the interpretation are well stated	Student's explanation is fairly correct with some errors and the interpretation are less appropriate	Student's explanation is incorrect and the interpretation are inappropriate
	5.2. Student's is able to explain application finite automata and implementation graph in computer science.	Application is fully correct and the interpretation are clearly stated	Application is mostly correct with minor error and the interpretation are well stated	Application is fairly correct with some errors and the interpretation are less appropriate	Application is incorrect and the interpretation are inappropriate

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