Discrete Mathematics for Computer Science ● Glossary of Terms

For the new Standard Course of Study that will be effective in all North Carolina schools in the 2020-21 School Year.

This document is designed to help North Carolina educators teach **Discrete Mathematics for Computer Science** Standard Course of Study. NCDPI staff are continually updating and improving these tools to better serve teachers and districts.

What is the purpose of this tool?
This tool provides educators with terminologies that represent the concepts and ideas teachers need to know and understand in order to effectively teach the North Carolina Standard Course of Study and use supporting materials. The Glossary of Terms is not meant to be exhaustive, but seeks to address critical terms and definitions essential in building content knowledge and understanding but also in promoting consistency across disciplines, increased student outcomes, and improved parent communication. This is a living document and will undergo revision and additions in terms over time.

How do I send Feedback?
We intend the explanations and examples in this document to be helpful and specific. That said, we believe that as this document is used, educators will find ways in which the tool can be improved and made even more useful. If there are terms which are either omitted or which you feel are misrepresented in this glossary, please send feedback by completing the Feedback on Mathematic Support Documents form.

Where are the standards and unpacking documents for the North Carolina Standard Course of Study for mathematics?
All standards are located at https://www.dpi.nc.gov/teach-nc/curriculum-instruction/standard-course-study/mathematics

Glossary by Objective

Number and Quantity		
Objective	**Word**	**Definition**
DCS.N.1.1	matrix	A rectangular array of elements organized in rows and columns.
DCS.N.1.2	vector	A quantity having both magnitude and direction.
DCS.N.1.3	Inverse Matrix	A^{-1} is an inverse matrix of A if and only if $A^{-1} \cdot A = A \cdot A^{-1} = I$, where I is the identity matrix. An inverse matrix does not exist for all matrices.
DCS.N.2.2	Leslie Models	The Leslie model is $P_k = P_0 \cdot L^k$, where P_0 is the initial population matrix, L is the Leslie matrix, and k is the number of cycles. This model, named after P.H. Leslie, is most often used to model population growth over time when given a population age distribution, with corresponding birth and survival rates.
	Markov Chains	A Markov chain is $D_k = D_0 \cdot T^k$, where D_0 is the initial-state matrix, T is the transition matrix, and k is the number of transitions. Markov chains, named after Andrei Markov who studied linked chains of events, begins with an initial-state matrix that is multiplied by a transition matrix to produce the next state.
DCS.N.2.3	matrix equation	An equation in which the variable is a matrix or elements within a matrix.
DCS.N.3.1	subset	A set is a subset if all the elements in the set are contained within another set. For example, set A is a subset of set B if all of the elements of set A are also elements in set B. It can also be said that set B is a <u>superset</u> of set A.
	proper subset	A subset is a proper subset if the elements of the subset do not contain all of the elements of the superset. For example, set A is a proper subset of set B if set B contains elements that are not in set A.
DCS.N.3.2	set operations	Defined criteria that construct new sets from given sets. The set operations are unions, intersections, complements, and set differences.
	set difference	The set difference of sets A and B is the set of elements in set A that are not in set B.
DCS.N.3.3	Venn diagram	A diagram representing the relationship between mathematical or logical sets pictorially within an

		area defined as the universal set. Sets are often represented with circles with elements common to the sets located with the areas where the circles, representing the sets, overlap.
DCS.N.4.1	Euclidean Algorithm	An iterative process used by technology to determine the greatest common factor and least common multiple for numbers a and b, such that $a > 0$ and $b > 0$.
DCS.N.4.2	Fundamental Theorem of Arithmetic	If $n > 1$ and is an integer, than n can we rewritten as a product of prime numbers that is unique to n.

Functions

Objective	Word	Definition
DCS.F.1.2	sigma notation	The representation of the sum of a series using the Greek letter sigma. This notation is used to represent finite or infinite series. This notation is a shorthand way of representing each element in the series as the elements relate to each other.
DCS.F.1.3	finite sequence	A sequence in which the number of elements is finite, or countable.
DCS.F.1.4	infinite sequence	A sequence in which the number of elements is infinite, or uncountable.
	converge	An infinite series converges when the sum of the elements approach a value without going over that value.
	diverge	An infinite series diverges when the sum of the elements is infinite.

Statistics & Probability

Objective	Word	Definition
DCS.SP.1.1	Fundamental Counting Principle	If one event can occur m ways and a second event can occur n ways after the first event, then the two events can occur in $m \cdot n$ ways.
DCS.SP.1.2	permutation	The selection of subsets, without replacements, when the order of selection is a factor.

	combination	The selection of subsets, without replacements, when the order of selection is not a factor.

Graph Theory		
Objective	Word	Definition
DCS.GT.1.1	vertex-edge graph	A graph that consists of points (vertices) and connections between the points (edges) that represent a context.
	adjacency matrix	A matrix representing a vertex-edge graph in which the rows and columns are the vertices of the graph. The elements of the graph are 1s or 0s in which adjacent vertices are represented with a 1 and non-adjacent vertices are represented with a 0.
	vertex-edge table	A table which displays the number of edges from each vertex. The number of edges from a vertex is also known as the degree of that vertex. In some cases, the vertex-edge table also includes a listing of all adjacent vertices. Also known as an edge table.
DCS.GT.1.2	path	A sequence of adjacent vertices, vertices connected by an edge. In a path, an edge can only be used once.
	circuit	A path that starts and ends at the same vertex.
	Euler path	A graph or digraph in which when starting at a vertex, one can travel through each edge exactly once and end at a different vertex.
	Euler circuit	A graph or digraph in which when starting at a vertex, one can travel through each edge exactly once and end at the starting vertex.
	Hamiltonian path	A graph or digraph in which when starting at a vertex, one can travel through each vertex exactly once and end at a different vertex.
	Hamiltonian circuit	A graph or digraph in which when starting at a vertex, one can travel through each vertex exactly once and end at the starting vertex.
DCS.GT.1.3	complete graph	A graph is complete if all vertices are connected to all other vertices by an edge.

	digraph	A directed graph in which the flow is from one vertex to another vertex represented by arrows.
DCS.GT.2.1	critical path	The path from a vertex to the end of a project with the longest processing time.
	minimum project time	The sum of the processing times for each task in the critical path. Also known as the <u>critical time</u>. The minimum project time provides an estimate of the minimum time needed to complete a project.
DCS.GT.2.2	Traveling Salesperson Problem	A category of problem, involving Hamiltonian circuits, in which the goal is to determine the most efficient pathway.
	brute force method	A method used to find the optimal solution to a Traveling Salesperson Problem. In this method, all possible Hamiltonian circuits are listed and the most optimal circuit is chosen.
	nearest-neighbor algorithm	An efficient method to find a solution to a Traveling Salesperson Problem. In this method, a starting vertex is chosen and the circuit is completed by taking the next edge with the lowest weight until the circuit is complete, avoiding any cycles.
	cheapest-link algorithm	An efficient method to find a solution to a Traveling Salesperson Problem. In this method, the circuit is constructed with the lowest weight edges of the graph, avoiding any cycles.
DCS.GT.2.3	vertex-coloring	A way of using colors to label vertices to solve problems involving constraints. Vertices connected by an edge must have different colors. The solution to these problems is found by minimizing the number of colors used in the graph. This number is known as the chromatic number.
DCS.GT.2.4	connected graph	A graph is connected if a path joins any two vertices. When referring to a real-life application, a connected graph is commonly referred to as a network.
	spanning tree	A subgraph that includes all vertices of the original graph with no circuits.
	minimum spanning tree	A subgraph with the least total weight that includes all vertices of the original graph with no circuits
	weight of a path	The sum of all values of interest included in a path.
	Kruskal's algorithm	A method to identify a minimum spanning tree and the weight of that tree. In this method, the minimum spanning tree is constructed by marking the edges in order of the least weight, avoiding

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	Prim's algorithm	the creation of a cycle, until n-1 edges have been marked.
	Prim's algorithm	A method to identify a minimum spanning tree and the weight of that tree. In this method, the minimum spanning tree is constructed by marking the edge with the least weight and marking the next lowest edge adjacent to the edge just marked, avoiding the creation of a cycle. This pattern is repeated until all vertices are connected to the tree.

Logic

Objective	Word	Definition
DCS.L.1.1	truth table	A table that shows the truth-value of a compound statement for every truth value of its component statements.
DCS.L.1.2	tautology	Assertions that are true in all interpretations
	contradiction	Assertions that are incompatible or incongruous
DCS.L.1.3	Boolean	A logical combinatorial system that represents, symbolically, relationships between entities such as sets, propositions, or on-off computer circuit elements.

Glossary by Alphabetical Order

Word	Definition
adjacency matrix	A matrix representing a vertex-edge graph in which the rows and columns are the vertices of the graph. The elements of the graph are 1s or 0s in which adjacent vertices are represented with a 1 and non-adjacent vertices are represented with a 0.
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cheapest-link algorithm	An efficient method to find a solution to a Traveling Salesperson Problem. In this method, the circuit is constructed with the lowest weight edges of the graph, avoiding any cycles.
circuit	A path that starts and ends at the same vertex.
combination	The selection of subsets, without replacements, when the order of selection is not a factor.
complete graph	A graph is complete if all vertices are connected to all other vertices by an edge.
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contradiction	Assertions that are incompatible or incongruous
converge	An infinite series converges when the sum of the elements approach a value without going over that value.
critical path	The path from a vertex to the end of a project with the longest processing time.
digraph	A directed graph in which the flow is from one vertex to another vertex represented by arrows.
diverge	An infinite series diverges when the sum of the elements is infinite.
Euclidean Algorithm	An iterative process used by technology to determine the greatest common factor and least common multiple for numbers a and b, such that $a > 0$ and $b > 0$.
Euler circuit	A graph or digraph in which when starting at a vertex, one can travel through each edge exactly once and end at the starting vertex.
Euler path	A graph or digraph in which when starting at a vertex, one can travel through each edge exactly once and end at a different vertex.
finite sequence	A sequence in which the number of elements is finite, or countable.
Fundamental Counting Principle	If one event can occur m ways and a second event can occur n ways after the first event, then the two events can occur in $m \cdot n$ ways.
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