Tackling the Terminology of *Networks*

Name:

By the end of this topic, all the terminology below should be defined in a row of this table.
This task is best completed as the topic progresses rather than waiting til the end of the topic.
There are some empty rows at the end of the table if you encounter terminology that is not on the list.
‘ # Gloss.’ indicates that a definition is provided in NESA’s Glossary, here.

Part 1 of 8: Diagrams and tables (Standard 1 and Standard 2)

Terminology	Formal definition	Example and plain-English definition
network # Gloss.	A network is a group or system of interconnecting objects which can be represented as a diagram of connected lines (called edges) and points (called vertices). For example a rail network.	
network diagram # Gloss.	A network diagram is a representation of a group of objects called vertices that are connected together by lines called edges. Also known as a network graph.	
vertex # Gloss.	A vertex is a point in a network diagram at which lines of pathways (called edges) intersect or branch. Also called a node. Plural of vertex is ‘vertices’.	
edge # Gloss.	In a network diagram, an edge refers to a line which joins vertices to each other. Also called an arc.	
degree of a vertex	The degree of a vertex is how many edges join at that point.	

loop	A loop is when a vertex is joined to itself by an edge.	
multiple edges	Multiple edges may exist between two vertices.	
simple network	A simple network is one that contains no loops or multiple edges.	
connected network	For any two vertices on the network, a path connecting them can be found.	
complete network	Every vertex is connected by one edge to every other vertex. A classic example is the network diagram representation of the handshake problem.	
planar network	Edges are allowed to cross where there is no vertex, BUT this must be kept in mind when travelling around the network that you cannot change edges there. A planar network is one where no edges cross unless there is a vertex at the crossing point.	
weighted edge # Gloss.	A weighted edge is an edge of a network diagram that has a number assigned to it which implies some numerical value such as cost, distance or time.	

weighted network	A weighted network is a network whose edges are weighted.	
directed network # Gloss.	A directed network is a network whose edges have arrows and travel is only possible in the direction of the arrows.	
bipartite graph	A bipartite graph is a graph or network whose vertices can be divided into two disjoint sets such that no two vertices in the same set are directly connected by an edge.	

Part 2 of 8: Investigating and solving practical problems (Standard 2 only)		
Terminology	**Formal definition**	**Example and plain-English definition**
degree of a vertex	The degree of a vertex is how many edges join at that point.	
walk	A walk is a sequence of vertices connected by edges such that the end vertex of one edge is the start vertex of the next. It is any route through a network diagram from one vertex to another vertex.	
trail	A walk that doesn't pass along the same edge twice. It may visit the same vertex twice but from a different edge each time.	

Königsberg Bridge problem # Gloss.	The Königsberg Bridge problem asked whether the seven bridges of the old city of Königsberg could all be crossed only once during a single trip that starts and finishes at the same place.	

Part 3 of 8: Minimum spanning trees (Standard 1 and Standard 2)		
Terminology	**Formal definition**	**Example and plain-English definition**
walk	A walk is a sequence of vertices connected by edges such that the end vertex of one edge is the start vertex of the next. It is any route through a network diagram from one vertex to another vertex.	
trail	A walk that doesn't pass along the same edge twice. It may visit the same vertex twice but from a different edge each time.	
path # Gloss.	A path in a network diagram is a walk in which all of the edges and all the vertices are different. A path that starts and finishes at different vertices is said to be open, while a path that starts and finishes at the same vertex is said to be closed. There may be multiple paths between the same two vertices.	
cycle	A cycle is a closed walk where only the initial and final vertices are the same. In other words a cycle is a closed path.	
tree # Gloss.	A tree is an undirected network in which any two vertices are connected by exactly one path. A tree has no cycles	

spanning tree # Gloss.	A spanning tree of an undirected network diagram is a tree which includes all the vertices of the original network connected together, but not necessarily all the edges of the original network diagram. A network can have many different spanning trees.	
minimum spanning tree # Gloss.	A minimum spanning tree is a spanning tree of minimum length in a connected, undirected network. It connects all the vertices together with the minimum total weighting for the edges.	
greedy algorithm	An algorithm that makes an optimal choice at each stage with no reference to what has happened previously or what may happen in the future.	
Kruskal's algorithm # Gloss.	Kruskal's algorithm finds a minimum spanning tree for a connected weighted network graph.	
Prim's algorithm # Gloss.	Prim's algorithm determines a minimum spanning tree for a connected weighted network.	

Part 4 of 8: Using minimum spanning trees to solve minimal connector problems
There is no new terminology in this section

Part 5 of 8: Shortest paths (Standard 1 and Standard 2)		
Terminology	**Formal definition**	**Example and plain-English definition**

shortest path # Gloss.	A shortest path in a network diagram is a path between two vertices in a network where the sum of the weights of its edges are minimised.	
Dijkstra's algorithm	A labelling algorithm that can be used to find the shortest path in a network diagram.	

Part 6 of 8: Activity charts and network diagrams (Standard 2 only)		
Terminology	**Formal definition**	**Example and plain-English definition**
activity chart or activity table	A table or chart that lists a series of activities and their order of precedence. For example, for one activity, the table would list the activity, how long it will take, and the prerequisite activities (which activities have to have happened before that one). Also called precedence tables or dependence tables.	
source vertex	This is the vertex at which the series of activities begins (the project is started). It is often notated by "s".	
sink vertex	This is the vertex at which the series of activities is complete (the project is finished). It is often notated by "t".	
dummy activity	Used to represent dependencies from the activity table in a network diagram when two chains have a common event but they are themselves wholly or partly independent of each other. A dummy activity is usually shown as a dotted line. Its direction is important but it has zero duration.	

Part 7 of 8: Critical path (Standard 2 only)		
Terminology	**Formal definition**	**Example and plain-English definition**
critical path # Gloss.	The critical path is the sequence of network activities which combine to have the longest overall duration so as to determine the shortest possible time needed to complete a project. The critical path through a project network is the longest path from the start to the finish. The critical path gives the minimum time for completion of a project.	
critical step	Each activity on the critical path is called a critical step. Any delay to a critical step means a delay of the whole project.	
earliest starting time (EST) # Gloss.	The earliest starting time is the earliest time that any activity can be started after all prior activities have been completed.	
latest starting time (LST) # Gloss.	The latest starting time is the latest time an activity may be started after all prior activities have been completed and without delaying the project.	
float time # Gloss.	Float time is the amount of time that a task in a project network can be delayed without causing a delay to subsequent tasks. The float time of an activity is the maximum delay possible in starting that activity that does not affect the completion time of the project.	
forward scanning	The process of finding the earliest start times for all activities in a network.	

backward scanning	The process of finding the latest start times for all activities in a network.	

Part 8 of 8: Network flow (Standard 2 only)		
Terminology	**Formal definition**	**Example and plain-English definition**
source	This is the vertex at which the flow begins. It is often notated by “s”.	
sink	This is the vertex at which the flow finishes. It is often notated by “t”.	
capacities	The weights of the edges are called capacities in a network flow diagram. This indicates what the maximum flow could be along that edge. N.B. Careful not to mix up the actual flow along an edge with the capacity of that edge.	
inflow	The inflow of a vertex is the sum of actual flows along the edges leading into that vertex (not capacities).	
outflow	The outflow of a vertex is the sum of actual flows along the edges leading out of that vertex (not capacities).	

saturated	An edge which is carrying a flow that is equal to its capacity is said to be saturated (at maximum capacity).	
excess flow capacity	The difference between the actual flow along an edge and its capacity is the excess flow capacity (how much more could flow along the edge if required). For a saturated edge this is 0.	
flow capacity # Gloss.	The flow capacity of a network can be found using the maximum-flow minimum-cut theorem and depends upon the capacity of each edge in the network. The flow capacity can be found for an edge, or for a vertex or for an entire network.	
cut	A cut is any continuous line which separates s from t. A cut must not pass through any vertices.	
maximum-flow minimum-cut theorem # Gloss.	The maximum-flow minimum-cut theorem states that the flow through a network cannot exceed the value of any cut in the network and that the maximum flow equals the value of the minimum cut, i.e. it identifies the ‘bottle-neck’ in the system.	