Spanning Trees of a Triangle Snake Graph by BFS and DFS Algorithms

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Abstract*: *Possible spanning trees of a triangular snake graph are outlined and extracted the spanning trees of a triangular snake graph by applying the method of breadth-first search and depth-first search algorithms; shows arrived spanning trees are not identical.

Index Terms*: *Graph; triangular snake graph; tree; spanning tree; complement; algorithm; breadth-first search; depth-first search Subject classification codes: 05C05; 05C85

I. INTRODUCTION

Here we introduce the spanning trees of a triangular snake graph by applying breadth-first search and depth-first search algorithms. The graph (V, E) is denoted by $G = G(V, E)$ where V is called the vertex set contains n vertices and E is called the edge set contains m edges. A graph G is said to be a tree if it is connected and has no cycles. A subgraph T of G is called a spanning tree of G if T is a tree and T contains all vertices of G(Chandrasekharaiah **2012**). A triangular snake graph is a triangular cactus graph whose block-cut point graph is a path. A triangular snake graph has $(2n + 1)$ vertices and $(3n)$ edges, where n is the number of blocks in the triangular snake graph and it is denoted by $(TS)_n$ (Selvi **2015**).

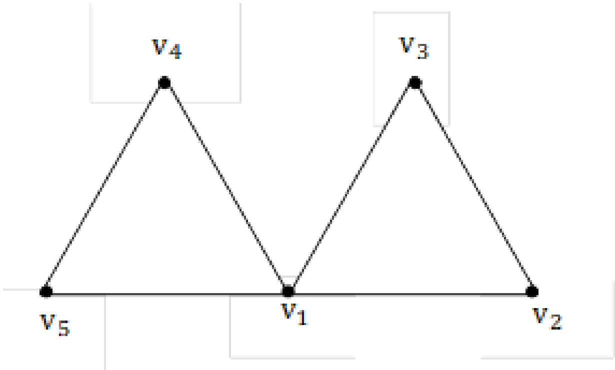


Figure 1.Triangular snake graph $G = (TS)_2$

Graph $G = (TS)_2$ is a closed walk has $n = 5$, $m = 6$, 2-Blocks, $m - n + 1 = 2$ chords with respect to spanning tree (T) and T has $(n - 1) = 5$ edges. The complement of T in G is denoted by $\overline{T}$ or T^c. Spanning trees of triangular snake graph $G = (TS)_2$ are shown in Figures 2(a) to (i).

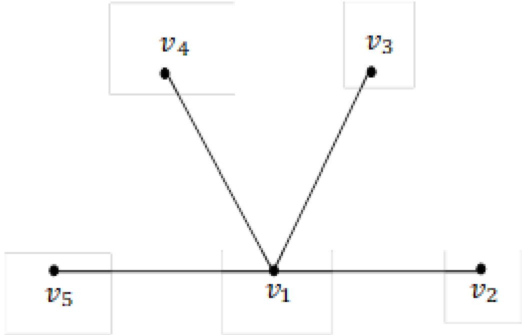
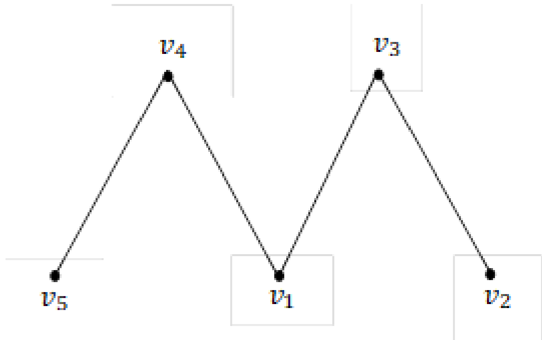


Figure 2 (a)



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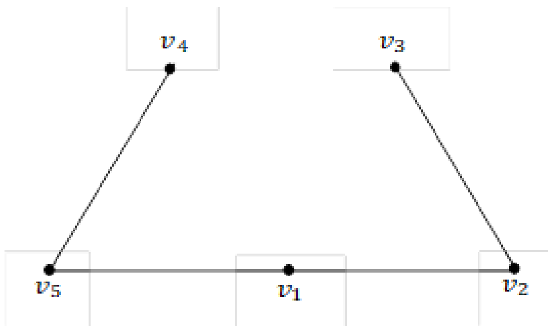

Figure 2 (c)

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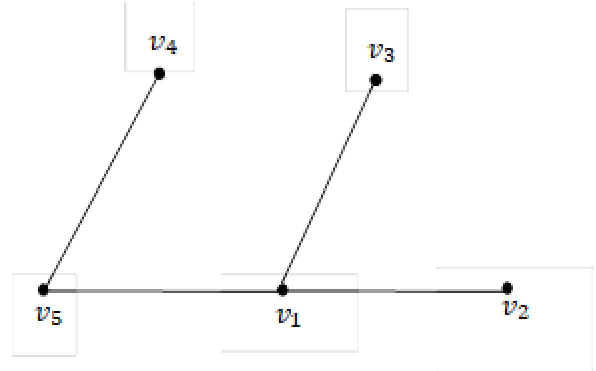
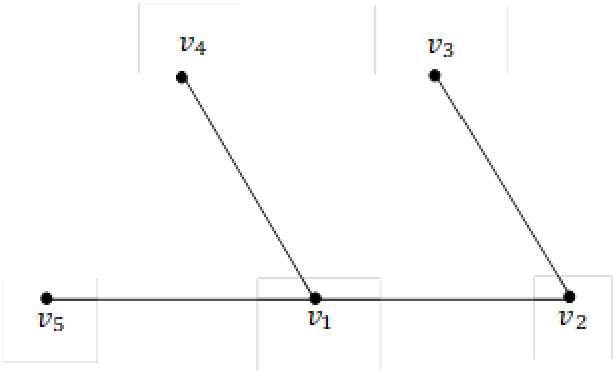


Figure 2 (d)



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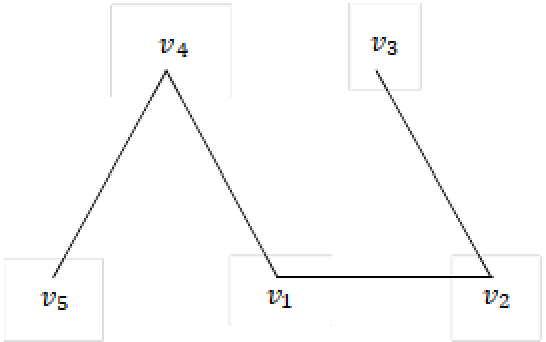

Figure 2 (f)

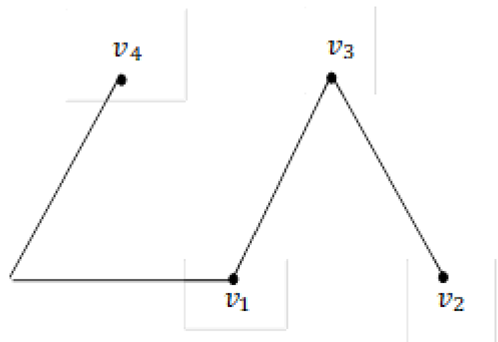

Figure 2 (g)

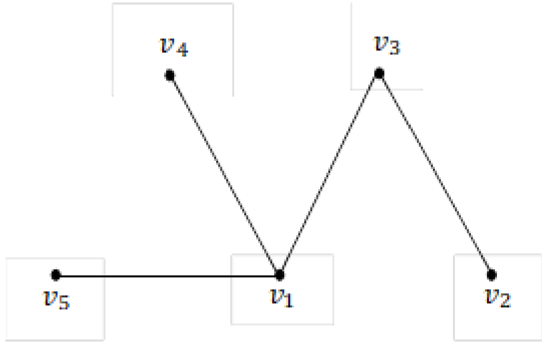

Figure 2 (h)

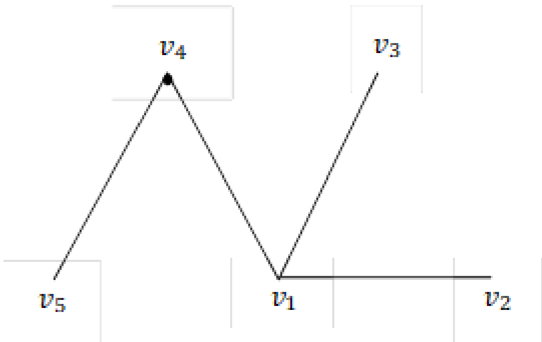

Figure 2 (i)

Figure 2 (a-i). Spanning trees of triangular snake graph

$G = (TS)_2$

II. RESULTS AND DISCUSSION

In this section, we are applying two methods to find a spanning tree of a connected graph called triangular snake graph. The first of these is known as the breadth-first search (BFS) and the second is known as the backtracking or depth-first search (DFS) algorithms (Grimaldi and Ramana 2004).

A. *Breadth-First Search (BFS) algorithmic method*

Step 1. Start with vertex v_1 . Insert v_1 in queue Q and initialize tree T as this vertex. (This vertex will turn out to be the root of the resulting tree T).

Step 2. We delete v_1 from Q and visit the vertices adjacent to it, namely v_1, v_2, v_3, v_4 (These vertices have not been previously considered). This results in our attaching to T the edges { v_1, v_2}, { v_1, v_3}, { v_1, v_4},{ v_1, v_5}.

Step 3. We insert v_2, v_3, v_4, v_5 in Q . Returning to Step 2, we delete each of these vertices from Q. At this stage, all the vertices of G have been visited and we stop the process.

Thus, a spanning tree that consists of the edges $\{v_1 , v_2\}$, $\{v_1 , v_3\}$, $\{v_1 , v_4\}$, $\{v_1 , v_5\}$ has been determined.

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This breadth-first search spanning tree is shown in Figure 3.

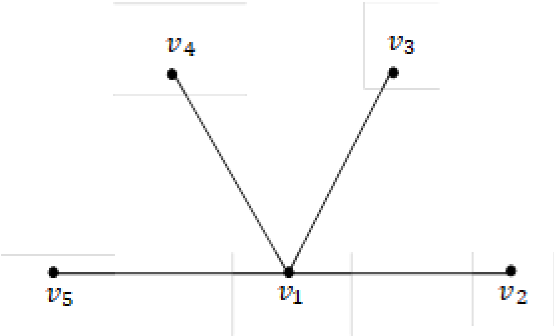


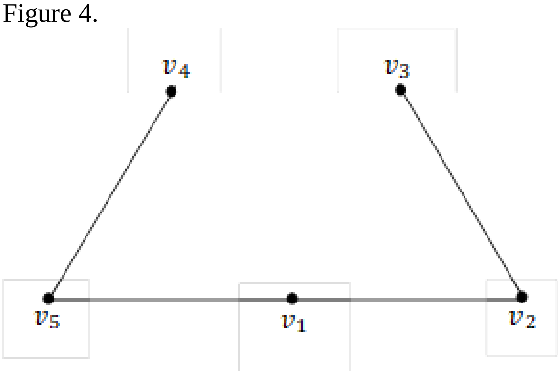
Figure 3. Breadth-First Search Spanning Tree

B. Depth-First Search (DFS) algorithmic method

Step 1. Assign the first vertex v_1 to the variable v and initialize tree T as just the vertex v_1 (the root).

Step 2. We find that the vertex v_2 is the first vertex w such that $\{v_1, w\} \in E$ and w has not been considered earlier. So, we attach the edge $\{v_1, v_2\}$ to T, assign v_2 to v and return to Step 2. At $= v_2$, we find that the first adjacent vertex(not considered earlier) that provides an edge for T is v_3. Consequently, the edge $\{v_2, v_3\}$ is attached to T, v_3 is assigned to v and we again return to Step 2 in such a way that no cycles formed in the graph. Now, we note that there is no new vertex which we can obtain from v_3, because the adjacent vertex v_1 has already been considered. Step 3. Continuing the process, we attach the edges $\{v_1, v_5\}$ and $\{v_5, v_4\}$ to T.

Thus, a spanning tree that consists of the edges $\{v_1, v_2\}$, $\{v_2, v_3\}$, $\{v_1, v_5\}$, $\{v_5, v_4\}$ has been determined. Continue this process till all the vertices of the G have been visited. This depth-first search spanning tree is shown in Figure 4.



For a given triangular snake graph, the breadth-first search and the depth-first search spanning trees are not identical (even for a given order of the vertices of G).

III. CONCLUSION

We have tried to present the possible spanning trees of a special graph called triangular snake graph. By applying the method of breadth-first search and depth-first search algorithms, we verified the spanning trees of a triangular snake graph with possible spanning trees and also observed that the arrived spanning trees are not identical.

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