Visualization of cordial graph in human excretion track

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Abstract. The quantitative research study of this paper is to show the relationship between cordial graphic topological space and its uses in the blood circulation of the human kidney.
Keywords: Alexandroff space, sum cordial graphs, subbasis.

1. Introduction

Linear graphs are used in mathematics field to model many real life phenomena. A linear graph (finite graph) G is Haussdroff space (T_2-Space) that is written as the uniform of finitely many edges (arcs), each pair of which intersect in at most a common end vertex (point). Any graph G is determined completely (up to homeomorphism) by listing its vertices (points) and specifying which pairs of vertices (points) have an edge (arc) joining them; however we shall look at them as interesting spaces that in some sense are generalizations of simple curves.

The concept of the topological space grew out of the study of the real line and metric space. The definition of a topological space that's currently standard was a long time on being developed. Several mathematicians like Frechet, Hausdroff, et al proposed many alternative definitions over a amount of years throughout the primary decades of the 20th century. Properly speaking, a topological space

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is a set X along with a collection of subsets of X, known as open sets, such $\emptyset$ set and X are each open and such, arbitrary unions and finite intersections of open sets are open. Exploiting this terminology, one can say that a topological space as being one thing sort of a truckload full of gravel, the pebbles and every one unions of collections of pebbles being open sets. If now, we have a tendency to smash the pebbles into smaller ones the collection of open sets has been enlarged and also the topology, just like the gravel is said to have been created finer by the mathematical operation. We were able to specify the topology by describing the whole collection τ of open sets. If the topology generated by the basis then the topology is called standard topology on the real line. The topology generated by the subbasis S is defined to be the collection τ of all unions of finite intersections of elements of S. The subbasis were defined as, If X is a set, a subabsis S for a topology on X is a collection of subsets of X whose union equals X.

Topological space is called by Alexandroff space if every point has a minimal neighborhood or equivalently, has unique minimal base. This is also equivalent to the fact that the intrersection of every family of open set is open. Alexandroff space was first introduced by P. Alexandroff in 1937 (
citer1).

Shiama was introduced the concepts of sum cordial labeling of graph [9]. If the vertices or edges or both of the graph $G = (V(G), E(G))$ are assigned values subject to certain conditions it is known as graph labeling ([3]).

Blood circulation is the very important for a healthy body, because blood is a living fluid. It transports, oxygen and other essential substances throughout the body, fights sickness, and performs other vital functions.

The kidneys are two bean shaped organs in the renal systems. They will help the body pass waste as urine and filter blood before sending it back to the human heart. They perform vital role like maintaining overall fluid balance, regulating and filtering minerals from food, filtering waste materials from food, medications and toxic substances and creating hormones that will help to produce red blood cells, promote bone health and regulate blood pressure. In this paper we analyzed, interior of the path and closure of the path are ever used in human kidney.

2. Preliminaries

Definition 2.1 ([1]). *Let X be a topological space, then X is an Alexandroff space if arbitarary intersection of open sets are open.*

Definition 2.2 ([3]). *A mapping $f : V(G) \to \{0,1\}$ is called binary vertex labeling of G and $f(v)$ is called the label of the vertex v of G under f.*

The induced edge labeling $f^* : E(G) \to \{0,1\}$ is given by $f^*(e = uv) = |f(u) - f(v)|$. Let us denote $v_f(0), v_f(1)$ be the number of vertices of G having labels 0 and 1 respectively under f and $e_f(0), e_f(1)$ be the number of edges of G having labels 0 and 1 respectively under f^*.

Definition 2.3 ([3]). *A binary vertex labeling of a graph G is called a cordial labeling if $|v_f(0)-v_f(1)| \leq 1$ and $|e_f(0)-e_f(1)| \leq 1$. A graph G is called cordial if it admits labeling.*

Definition 2.4 ([3]). *A binary vertex labeling of a graph G with induce edge labeling $f^* : E(G) \to \{0,1\}$ defined by $f^*(uv) = |f(u)+f(v)|(mod 2)$ is called sum cordial labeling if $|v_f(0)-v_f(1)| \leq 1$ and $|e_f(0)-e_f(1)| \leq 1$. A graph G is called sum cordial if it admits sum cordial labeling.*

Definition 2.5 ([9]). *p_n is path of length $n-1$.*

Definition 2.6 ([10]). *The path p is called Topological open subgraph if the subgraph not contained its end point. The path p is called Topological closed subgraph if the subgraph contained its initial and its end points.*

Definition 2.7 ([10]). *The path p is called Topological open path if the path not contained its end point. The path p is called Topological closed path if the path contained its initial and its end points.*

Definition 2.8 ([9]). *Let $G = (V(G), E(G))$ be a simple graph with sum cordial labeling and with out isolated vertex. Define S_{0G} and S_{1G} as follows. $S_{0G} = \{A_{v(0)}|v \in V\}$ and $S_{1G} = \{A_{v(1)}|v \in V\}$ such that $A_{v(0)}$ and $A_{v(1)}$ is the set of all vertices adjacent to v of G having label 0 and 1, respectively. Since G has no isolated vertex, $S_{0G} \cup S_{1G}$ forms a subbasis for a topology τ_{CG} on V is called Cordial graphic topology of G and it is denoted by (V, τ_{CG}).*

Definition 2.9 ([9]). *Cordial graphic topology of G is called Cordial Alexandroff topological space if and only if arbitrary intersection of members of $S_{0G} \cup S_{1G}$ is open in τ_{CG}.*

Proposition 2.10 ([9]). *Suppose that $G = (V, E)$ is a sum cordial graph then the graph G admits the cordial alexandroff topological space.*

3. New approach of closure and interior on cordial graphic topological space

Definition 3.1. *Let $G = (V, E)$ be a sum cordial graph which admits cordial graphic topology τ_{CG} and p be the path of graph G, then the interior of $V(p)$ has the form $Int[V(p)] = \{v \in V(p)|A_v \cap V(p) \neq \emptyset\}$ where A_v is the set of all vertices adjacent to v having the label 0 or 1.*

Definition 3.2. *Let $G = (V, E)$ be a sum cordial graph which admits cordial graphic topology τ_{CG} and p be the path of graph G, then the closure of $V(p)$ has the form $Cl[V(p)] = V(p) \cup \{v \in V|A_v \cap V(p) \neq \emptyset\}$ where A_v is the set of all vertices adjacent to v having the label 0 or 1.*

Example 3.3. Let us consider the sum cordial graph with $V = \{v_1, v_2, v_3, v_4\}$ and $E = \{e_1, e_2, e_3, e_4\}$. From the following Figure 1, we have $A_{v_1}(0) = \{v_2, v_3\}$,

$A_{v_2}(1) = \{v_1, v_3, v_4\}, A_{v_3}(0) = \{v_1, v_2\}, A_{v_4}(1) = \{v_2\}, S_{0G} = \{\{v_2, v_3\}, \{v_1, v_2\}\}$ and $S_{1G} = \{\{v_1, v_3, v_4\}, \{v_2\}\}$. Thus, $S_{0G} \cup S_{1G} = \{\{v_2, v_3\}, \{v_1, v_2\}, \{v_1, v_3, v_4\}, \{v_2\}\}$, $\tau_{CG} = \{V, \emptyset, \{v_2, v_3\}, \{v_1, v_2\}, \{v_1, v_3, v_4\}, \{v_2\}, \{v_2\}, \{v_1, v_2, v_3\}, \{v_3\}, \{v_1, v_3\}, \{v_1\}\}$ the graph admits cordial graphic topology.

Let us take path $p = v_1 e_1 v_2 e_3 v_3$ so $V(p) = \{v_1, v_2, v_3\}$. Thus, we have $Cl(V(p)) = \{v_1, v_2, v_3, v_4\}$ and $Int(V(p)) = \{v_1, v_2, v_3\}$

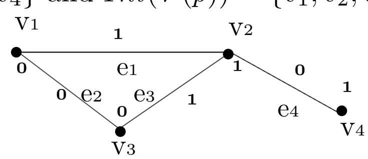

Figure 1:

Proposition 3.4. *Let $G = (V, E)$ be a sum cordial graph which admits cordial graphic topology. If p_1 and p_2 are two paths of G then:*

(i) $V(p_1) \subseteq Cl(V(p_1))$;

(ii) If $p_1 \subseteq p_2$ then $Cl(V(p_1)) \subseteq Cl(V(p_2))$.

Proof. (i) Let us assume that the vertex $v \in p_1$ having the label 0 or 1, so we have $v \in V(p_1)$, then from the definition of closure $Cl(V(p_1)) = V(p_1) \cup \{v \in V | A_v \cap V(p_1) \neq \emptyset\}$ so $v \in Cl(V(p_1))$, therefore $V(p_1) \subseteq Cl(V(p_1))$.

(ii) from(i) $V(p_1) \subseteq Cl(V(p_1))$ so $V(p_2) \subseteq Cl(V(p_2))$ and since $p_1 \subseteq p_2$ which implies that $V(p_1) \subseteq V(p_2)$ then $Cl(V(p_1)) \subseteq Cl(V(p_2))$. □

Example 3.5. Let G be a simple graph with $V = \{v_1, v_2, v_3, v_4, v_5\}$ and $E = \{e_1, e_2, e_3, e_4, e_5, e_6\}$. From the following Figure 2, we have

Here $v_f(0) = 3, v_f(1) = 2, e_f(0) = 3, e_f(1) = 3$. Therefore, $|v_f(0) - v_f(1)| \leq 1$ and $|e_f(0) - e_f(1)| \leq 1$. Thus, the graph admits sum cordial labeling.

Now, $A_{v_1(0)} = \{v_2, v_5\}, A_{v_2(0)} = \{v_1, v_3, v_4\}, A_{v_3(0)} = \{v_2, v_4\}, A_{v_4(1)} = \{v_2, v_3, v_5\} A_{v_5(1)} = \{v_1, v_4\}$, $S_{0G} = \{\{v_2, v_5\}, \{v_1, v_3, v_4\}, \{v_2, v_4\}\}$ and $S_{1G} = \{\{v_2, v_3, v_5\}, \{v_1, v_4\}\}$.

Thus, $S_{0G} \cup S_{1G} = \{\{v_2, v_5\}, \{v_1, v_3, v_4\}, \{v_2, v_4\}, \{v_2, v_3, v_5\}, \{v_1, v_4\}\}$ and $\tau_{CG} = \{V, \emptyset, \{v_2, v_5\}, \{v_1, v_3, v_4\}, \{v_2, v_4\}, \{v_2, v_3, v_5\}, \{v_1, v_4\}, \{v_2, v_5, v_4\}, \{v_1, v_2, v_4, v_5\}, \{v_1, v_2, v_3, v_4\}, \{v_2, v_3, v_4, v_5\}, \{v_1, v_2, v_4\}, \{v_4\}, \{v_2\}, \{v_3\}, \{v_2, v_3\}, \{v_3, v_4\}, \{v_2, v_3, v_4\}\}$. Here the graph admits cordial graphic topology.

Consider, $\tau^c_{CG} = \{\emptyset, V, \{v_1, v_3, v_4\}, \{v_2, v_5\}, \{v_1, v_3, v_5\}, \{v_1, v_4\}, \{v_2, v_3, v_5\}, \{v_1, v_3, v_4, v_5\}, \{v_1, v_2, v_3, v_5\}, \{v_1, v_2, v_4, v_5\}, \{v_1, v_3\}, \{v_5\}, \{v_1\}, \{v_1, v_4, v_5\}, \{v_1, v_2, v_5\}, \{v_3\}, \{v_1, v_5\}, \{v_3, v_5\}\}$. Let us consider the paths $p_1 = v_1 e_5 v_5$ and $p_2 = v_1 e_1 v_2 e_6 v_4 e_4 v_5$, so $V(p_1) = \{v_1, v_5\}$, $V(p_2) = \{v_1, v_2, v_4, v_5\}$. Thus, $Cl[V(p_1)] = \{v_1, v_2, v_4, v_5\}$ and $Cl[V(p_2)] = \{v_1, v_2, v_3, v_4, v_5\}$. Here, we proved (i) $V(p_1) \subseteq Cl(V(p_1))$ and (ii)If $p_1 \subseteq p_2$ then $Cl(V(p_1)) \subseteq Cl(V(p_2))$.

Proposition 3.6. *Let $G = (V, E)$ be a sum cordial graph which admits cordial graphic topology. If p_1 and p_2 are two paths of G then $Cl[V(p_1) \cup V(p_2)] = Cl[V(p_1)] \cup Cl[V(p_2)]$.*

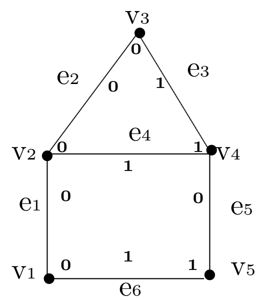

Figure 2:

Proof. Let us assume that $p_1 \cup p_2 = p_3$, where p_1 and p_2 are the open paths then $v \in p_3$, $v \in V$ having the label 0 or 1. Thus we have $V(p_3) = V(p_1) \cup V(p_2)$, then $v \in V(p_3)$, from above proposition we have, $v \in Cl[V(p_3)]$ which implies that $v \in Cl[V(p_1) \cup V(p_2)]$.

If $v \in Cl[V(p_1)] \cup Cl[V(p_2)]$,then $v \in Cl[V(p_1)]$ or $v \in Cl[V(p_2)]$ by using definition of closure we have $v \in V(p_1)$ or $v \in V(p_2)$. So $v \in V(p_1) \cup V(p_2)$ again using closure definition we have $v \in Cl[V(p_1) \cup V(p_2)]$. On the other hand, let us assume that $v \in V(p_3)$ which implies that $v \in V(p_1) \cup V(p_2)$ then $V(p_1) \cup V(p_2) = V[p_1 \cup p_2] = V(p_3)$. Now let $v \in V(p_3) \Rightarrow V(p_1 \cup p_2)$ then $v \in V(p_1)$ or $v \in V(p_2)$. If $v \in V(p_1)$ then from above proposition 3.4 we have $v \in Cl[V(p_1)]$ or if $v \in V(p_2)$ then from above proposition, we have $v \in Cl[V(p_2)]$, thus we have $v \in Cl[V(p_1)] \cup Cl[V(p_2)]$. □

Example 3.7. Let us consider the sum cordial graph with $V = \{a, b, c, d\}$ and $E = \{e_1, e_2, e_3, e_4\}$.

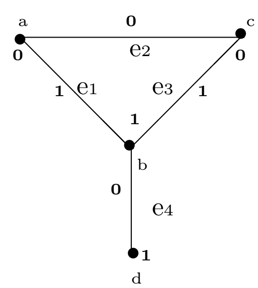

Figure 3:

From Figure 3, we have $\tau_{CG} = \{V, \emptyset, \{b, c\}, \{a, c, d\}, \{a, b\}, \{b\}, \{a, b, c\}, \{c\}, \{a, c\}, \{a\}\}$. Let us consider the paths,$p_1 = ae_1be_3, p_2 = ae_2ce_3$, so $V(p_1) =$

$\{a, b\}$ and $V(p_2) = \{a, c\}$. Here $Cl[V(p_1)] = \{a, b, c\}$, $Cl[V(p_2)] = \{a, b, c\}$ and $Cl[V(p_3)] = \{a, b, c\}$ (i.e) $Cl[V(p_1 \cup p_2)] = \{a, b, c\}$. Thus, we get $Cl[V(p_1) \cup V(p_2)] = Cl[V(p_1)] \cup Cl[V(p_2)]$.

Proposition 3.8. *Let $G = (V, E)$ be a sum cordial graph which admits cordial graphic topology. If p_1 and p_2 are two paths of G then $Cl[V(p_1) \cap V(p_2)] \subseteq Cl[V(p_1)] \cap Cl[V(p_2)]$.*

Proof. Let us assume that $p_1 \cap p_2 = p_3$, where p_1 and p_2 are the open paths then $v \in p_3$, $v \in V$ having the label 0 or 1.

Let us take $v \in Cl[V(p_1) \cap V(p_2)]$, then by using proposition 3.4 we have $v \in V(p_1) \cap V(p_2)$. This implies that $v \in V(p_1)$ and $v \in V(p_2)$, again using above proposition 3.4 we get $v \in Cl[V(p_1)]$ and $v \in Cl[V(p_1)]$, using this which implies that $v \in Cl[V(p_1)] \cap Cl[V(p_2)]$. □

Example 3.9. Let us consider the following paths from Figure 2 $p_1{=}v_1e_1v_2e_2v_3e_4$ and $p_2 = v_2e_4v_4e_5$ so, $V(p_1) = \{v_1, v_2, v_3\}$ and $V(p_2) = \{v_2, v_4\}$.

Here, $Cl[V(p_1)]{=}\{v_1, v_2, v_3, v_4, v_5\}, Cl[V(p_2)]{=}\{v_1, v_2, v_3, v_4, v_5\}$, $Cl[V(p_1)] \cap Cl[V(p_2)] = \{v_1, v_2, v_3, v_4, v_5\}$. Now, consider $V(p_3) = V(p_1) \cap V(p_2) = \{v_2\} \Rightarrow Cl[V(p_3)] = \{v_1, v_2, v_3, v_4\}$. That is $Cl[V(p_1) \cap V(p_2)] = \{v_1, v_2, v_3, v_4\}$. Thus, we have $Cl[V(p_1) \cap V(p_2)] \subset Cl[V(p_1)] \cap Cl[V(p_2)]$.

Example 3.10. Let us consider the following paths from Figure 3 $p_1 = ae_1be_3$ and $p_2 = ae_2v_4ce_3$ so, $V(p_1) = \{a, b\}$ and $V(p_2) = \{a, c\}$.

Here $Cl[V(p_1)] = \{a, b, c, d\}$ $Cl[V(p_2)] = \{a, b, c\}$, $Cl[V(p_1)] \cap Cl[V(p_2)] = \{a, b, c\}$. Now, consider $V(p_3) = V(p_1) \cap V(p_2) = \{a\} \Rightarrow Cl[V(p_3)] = \{a, b, c\}$. That is $Cl[V(p_1) \cap V(p_2)] = \{a, b, c\}$. Thus, we have $Cl[V(p_1) \cap V(p_2)] = Cl[V(p_1)] \cap Cl[V(p_2)]$.

4. Relation between cordial graphic topology and Kidney

In this section, we shall study the interior and closure of topological graph theory which plays a vital role in human kidney.

Firstly, we divide the human heart and kidney into a set of vertices and set of edges in order to find cordial graphic topology on it.

The vertex x_1 represent Pulmonary veins.
The vertex x_2 represent Left artrium.
The vertex x_3 represent Left ventricle.
The vertex x_4 represent aorta.
The vertex x_5 represent abdominal aorta.
The vertex x_6 represent left kidney.
The vertex x_7 represent right kidney.
The vertex x_8 represent inferior vena cave.
The vertex x_9 represent superior vena cava.
The vertex x_{10} represent Pulmonary artery.
The vertex x_{11} represent Left lung.

The vertex x_{12} represent Right lung.

The edges $e_1, e_2, e_3, e_4, e_5, e_6, e_7, e_8, e_9, e_{10}, e_{11}, e_{12}$ represent the blood circulate way through the human heart to kidney.

The following Figure 5 represents the blood circulation in human heart to kidney via graphs.

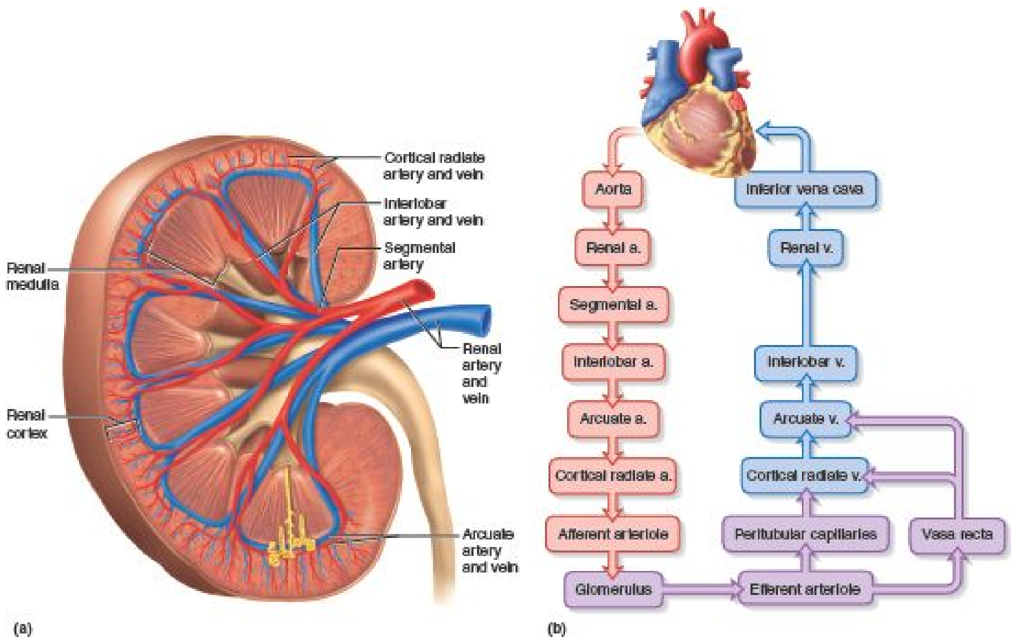

Figure 4: Blood circulation in human heart and Kidney
[colour figure can be viewed at https://www.pinterest.com/pin/305470787201652538/]

From the following Figure 6 we have, $v_f(0) = 6; v_f(1) = 6$ and $e_f(0) = 6; e_f(1) = 6$. Thus, we have $|v_f(0) - v_f(1)| \leq 1$ and $|e_f(0) - e_f(1)| \leq 1$. Thus, the graph admits sum cordial labeling. From graph we have $A_{x_1}(1) = \{x_2\}, A_{x_2}(1) = \{x_3\}, A_{x_3}(0) = \{x_4\}, A_{x_4}(0) = \{x_5\}, A_{x_5}(0) = \{x_6, x_7\}, A_{x_6}(0) = \{x_8\}, A_{x_7}(1) = \{x_8\}, A_{x_8}(1) = \{x_9\}, A_{x_9}(0) = \{x_{10}\}, A_{x_{10}}(1) = \{x_{11}, x_{12}\}$.

$S_{0G} = \{A_{x_3}(0), A_{x_4}(0), A_{x_5}(0), A_{x_6}(0), A_{x_9}(0)\}$ and $S_{1G} = \{A_{x_1}(1), A_{x_2}(1), A_{x_7}(1), A_{x_8}(1), A_{x_{10}}(1)\}$, $S_{0G} \cup S_{1G} = \{\{x_2\}, \{x_3\}, \{x_4\}, \{x_5\}, \{x_6, x_7\}, \{x_8\}, \{x_9\}, \{x_{10}\}, \{x_{11}, x_{12}\}\}$ and $\tau_{CG} = \{V, \emptyset, \{x_2\}, \{x_3\}, \{x_4\}, \{x_4\}, \{x_6, x_7\}, \{x_8\}, \{x_9\}, \{x_{10}\}, \{x_{11}, x_{12}\}\{x_2, x_3\}, \{x_2, x_4\}, \{x_2, x_5\}\{x_2, x_6, x_7\}, \{x_2, x_8\}, \{x_2, x_9\}, \{x_2, x_{10}\}, \{x_2, x_{11}, x_{12}\}, \{x_3, x_4\}, \{x_3, x_6, x_7\}, \{x_3, x_5\}, \{x_3, x_8\}, \{x_3, x_9\}, \{x_3, x_{11}, x_{12}\}, \{x_4, x_5\}, \{x_4, x_8\}, \{x_4, x_6, x_7\}, \{x_4, x_6\}, \{x_4, x_{10}\}, \{x_4, x_{11}, x_{12}\}, \{x_5, x_6, x_7\}, \{x_5, x_8\}, \{x_5, x_9\}, \{x_5, x_{10}\}, \{x_5, x_{11}, x_{12}\}, \{x_6, x_7, x_8\}, \{x_6, x_9\}, \{x_6, x_{10}\}, \{x_6, x_{11}, x_{12}\}, \{x_8, x_9\}, \{x_8, x_{10}\}, \{x_8, x_{11}, x_{12}\}, \{x_9, x_{10}\}, \{x_9, x_{11}, x_{12}\}, \{x_{10}, x_{11}, x_{12}\}, \{x_2, x_3, x_4\}, \{x_2, x_3, x_5\}, \{x_2, x_3, x_6, x_7\}, \{x_2, x_3, x_8\}, \{x_2, x_3, x_9\}$,

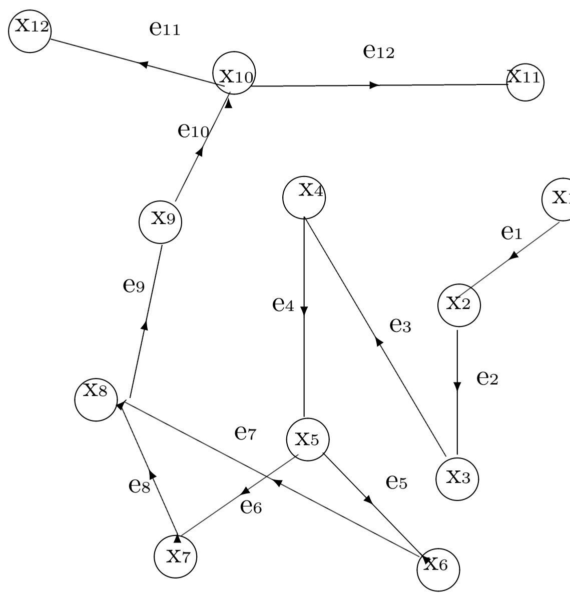

Figure 5:

$\{x_2, x_3, x_{10}\}, \{x_2, x_3, x_{11}, x_{12}\}, \{x_4, x_5, x_6, x_7\}, \{x_4, x_5, x_8\}, \{x_4, x_5, x_9\},$
$\{x_4, x_5, x_{10}\}, \{x_4, x_5, x_{11}, x_{12}\}, \{x_2, x_3, x_4, x_5\}, \{x_6, x_7, x_8, x_9\}, \{x_6, x_7, x_8, x_{10}\},$
$\{x_6, x_7, x_8, x_{11}, x_{12}\}, \{x_2, x_6, x_7, x_8\}, \{x_3, x_6, x_7, x_8\}, \{x_4, x_6, x_7, x_8\},$
$\{x_5, x_6, x_7, x_8\}, \{x_9, x_{10}, x_{11}, x_{12}\}, \{x_2, x_9, x_{10}\}, \{x_3, x_9, x_{10}\}, \{x_4, x_9, x_{10}\},$
$\{x_5, x_9, x_{10}\}, \{x_6, x_7, x_9, x_{10}\}, \{x_8, x_9, x_{10}\}, \{x_{10}, x_{11}, x_6, x_{12}, x_2\},$
$\{x_3, x_{10}, x_{11}, x_{12}\}, \{x_4, x_{10}, x_{11}, x_{12}\}, \{x_5, x_{10}, x_{11}, x_{12}\}, \{x_6, x_7, x_{10}, x_{11}, x_{12}\},$
$\{x_8, x_{10}, x_{11}, x_{12}\}, \{x_2, x_3, x_4, x_6, x_7\}, \{x_2, x_3, x_4, x_8\}, \{x_2, x_3, x_4, x_9\},$
$\{x_2, x_3, x_4, x_{10}\}, \{x_2, x_3, x_4, x_{11}, x_{12}\}, \{x_2, x_3, x_4, x_5, x_6, x_7\}, \{x_2, x_3, x_4, x_5, x_8\},$
$\{x_2, x_3, x_4, x_5, x_9\}, \{x_2, x_3, x_4, x_5, x_{10}\}, \{x_2, x_3, x_4, x_5, x_{11}, x_{12}\},$
$\{x_2, x_3, x_4, x_5, x_6, x_7, x_8\}, \{x_2, x_3, x_4, x_5, x_6, x_7, x_9\}, \{x_2, x_3, x_4, x_5, x_6, x_7, x_{10}\},$
$\{x_2, x_3, x_4, x_5, x_6, x_7, x_{10}, x_{11}, x_{12}\}, \{x_2, x_4, x_6, x_7, x_8, x_9, x_{10}, x_{11}, x_{12}\},$
$\{x_4, x_5, x_6, x_7, x_8, x_9, x_{10}, x_{11}, x_{12}\}, \{x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}, x_{11}, x_{12}\},$
$\{x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}, x_{11}, x_{12}\},$
$\{x_2, x_3, x_4, x_5, x_8, x_9, x_{10}\},$
$\{x_2, x_3, x_4, x_5, x_6, x_7, x_9, x_{10}, x_{11}, x_{12}\},$
$\{x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_{10}, x_{11}, x_{12}\},$
$\{x_2, x_3, x_4, x_6, x_7, x_{10}, x_{11}, x_{12}\},$
$\{x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}\}, ...\}.$

Let us consider the path without it's end point $p = x_1 e_1 x_2 e_2 e_3$ so we have $V(p) = \{x_1, x_2\}$, by using the resultant closure of the path is $Cl[V(p)] = \{x_1, x_2\}$. Medically, once we apply this instance within human body, we can realize it's true. As a result of the blood flow in an exceedingly heart in an

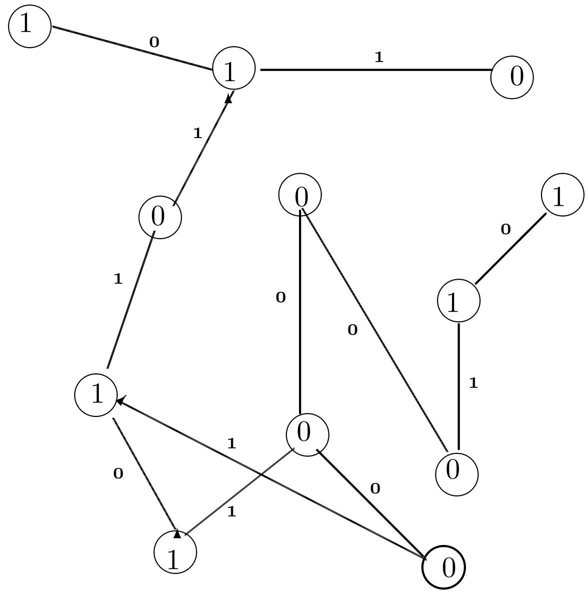

Figure 6: Sum cordial labeling on blood circulation in human heart to kidney

exceedingly directed path that means that the blood should be pass through every successive point till it completes its cycle.

Let us consider the path $p = x_4e_4x_5e_5v_6$ so, we have $V(p) = \{x_4, x_5, x_6\}$, by using the interior definition we get the interior of the path is $Int[V(p)] = \{x_4, x_5\}$, here the interior of the path does not consisit the end point. But we can apply this resultant inerior of the path in to the kidney.

Conclusion

Abdominal Aorta x_5 supplies blood supply to Left and Right Kidney via Left renal artery x_6 and Right renal artery x_7.

Problem occurring in x_6 Left renal artery affects Left Kidney alone and Problem occurring in x_7 Right renal artery affects Right Kidney alone.

Human body maintains excretory/function with one Kidney alone, even if there is problem in other Kidney. It is god's gift for us that we can live with one Kidney alone.

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