Sombor Gutman P_n F_m W

[12] [13]

Sombor

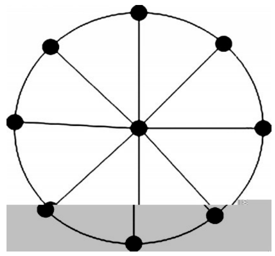
Sombor

1 [14] G H $V(G \square H) = V(G) \times V(H)$ (u_1, v_1)

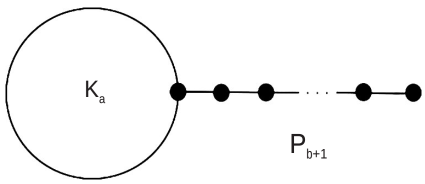
(u_2, v_2) $u_1 = u_2$ $v_1 v_2 \in E(H)$ $v_1 = v_2$ $u_1 u_2 \in E(G)$ 1

2 [15] G H $V(G \times H) = V(G) \times V(H)$

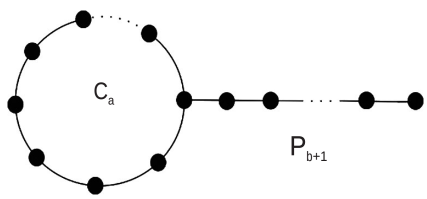
7 $N_{a,b}$ $b+1$ P_{b+1} a C_a 6
8 a C_a b C_b $b+1$ $P_{b+1}(b \geq 1)$ C_a
C_b P_{b+1} $D_{a,b,c}$ 7



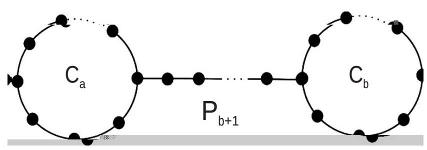
W_9



$N_{a,b}$



$L_{a,b}$



$D_{a,b,c}$

1 Sombor

Sombor

1 $G = P_n \square W_m$ Sombor

$$SO(G) = (11mn - 9n - 20m + 14)\sqrt{2} + 2\sqrt{2m^2 + 2m + 1}$$
$$+(n-2)(m-1)\sqrt{m^2 + 2m + 26} + 2(m-1)\sqrt{41} + 2(m-1)\sqrt{m^2 + 16}$$

$v(G) = mn$ $e(G) = 3mn - m - 2n.$ G $\delta_G = 4$ $_G = m + 1$ G 2
m m $(n-2)(m-1)$

$$= 2\sqrt{(m+1)^2+m^2}+(n-2)(m-1)\sqrt{(m+1)^2+5^2}+(2n-5)(m-1)\sqrt{5^2+5^2}$$

$$+2(m-1)\sqrt{4^2+5^2}+2(m-1)\sqrt{4^2+4^2}+2(m-1)\sqrt{4^2+m^2}+(n-3)\sqrt{(m+1)^2+(\qquad)}$$

$$SO(G)=\frac{1}{2}n\left(n^2a+n^2b+n^2c-n^2+2na+2nb+2nc-10n+a+b+c-13\right)\sqrt{2}+6n\sqrt{2n^2+6n+5}$$

$v(G)=n(a+b+c-1)$ $e(G)=\frac{1}{2}n(na+nb+nc-n+a+b+c+1)$. G $\delta_G=n+1$ ${}_G=n+2$ $n(n-1)$ 6n $\frac{1}{2}n(na+a+nb+b+nc+c-3n-9)$ G Sombor

$$SO(G)=\frac{1}{2}n\left(n^2a+n^2b+n^2c-n^2+2na+2nb+2nc-10n+a+b+c-13\right)\sqrt{2}+6n\sqrt{2n^2+6n+5}$$

8 $G=N_{a,b}\square K_n$ Sombor

$$SO(G)=\frac{1}{2}n\left(an^2+bn^2+2an+2bn+a+b-8n-8\right)\sqrt{2}+3n\sqrt{2n^2+6n+5}+n\sqrt{2n^2+2n+1}$$

$v(G)=n(a+b)$ $e(G)=\frac{1}{2}n(na+nb+a+b)$ G $\delta_G=n$ ${}_G=n+2$ $\frac{1}{2}n(n-1)$ 3n (δ_G+1) $\frac{1}{2}n(an+bn-2n+a+b-6)$ (δ_G+1) n (δ_G+1) $\frac{1}{2}n(n-1)$ G Sombor

$$SO(G)=\frac{1}{2}n\left(an^2+bn^2+2an+2bn+a+b-8n-8\right)\sqrt{2}+3n\sqrt{2n^2+6n+5}+n\sqrt{2n^2+2n+1}$$

3 Sombor

Sombor Sombor Sombor

9 G n k- H

$$SO(G\times H)=nk^2SO(H)$$

$V(G)=\{u_1,u_2,\quad,u_n\}$ $V(H)=\{v_1,v_2,\quad,v_m\}$ $E(G)=\{u_iu_j|1\le i,j\le n\}$ $E(H)=\{v_sv_l|1\le s,l\le m\}$ $V(G\times H)=\{u_iv_s|1\le i\le n,1\le s\le m\}$ $E(G\times H)=\{(u_iv_s)(u_jv_l)|1\le i,j\le n,1\le s,l\le m\}$ $d_G(u_i)=k$ $d_{G\times H}(u_iv_s)=d_G(u_i)d_H(v_s)=kd_H(v_s)$. $e_1=(u_iv_s)(u_jv_l)$ $E(G\times H)$ $e_2=(u_jv_s)(u_iv_l)$ $E(G\times H)$ $e(G\times H)=2e(G)e(H)$ $d_{G\times H}(u_iv_s)=d_{G\times H}(u_jv_s)$ $d_{G\times H}(u_iv_l)=d_{G\times H}(u_jv_l)$

$$SO(G\times H)=\sum_{(u_iv_s)(u_jv_l)\quad G\times H}\sqrt{d_{G\times H}{}^2(u_iv_s)+d_{G\times H}{}^2(u_jv_l)}=2k\frac{nk}{2}\sum_{v_sv_l\quad H}\sqrt{d_H{}^2(v_s)+d_H{}^2(v_l)}=nk^2SO(H)$$

4 Sombor

Sombor Sombor

10 1 $SO(K_n\square P_m)=2n\sqrt{2n^2+2n+1}+\left(\frac{1}{2}mn^3+mn^2+\frac{1}{2}mn-4n^2-2n\right)\sqrt{2}$

2 $SO(K_n\square C_m)=\frac{1}{2}nm(m+1)(n+1)\sqrt{2}$

3 $SO(K_n\times P_m)=(2n^3-4n^2+2n)\sqrt{5}+(2n^3m-4n^2m-6n^3+12n^2+2nm-6n)\sqrt{2}$ $(m>2)$

4 $SO(K_n\times C_m)=nm(m-2)(n-1)\sqrt{2}$

5 $SO(K_n\quad P_m)=2n^2\sqrt{13n^2-10n+2}+\left(\frac{9}{2}n^3m-3n^2m-10n^3+4n^2+\frac{1}{2}nm\right)\sqrt{2}$ $(m>2)$

6 $SO(K_n \quad C_m) = \frac{1}{2}nm(3n-1)^2\sqrt{2}$

7 $SO(P_n \times P_m) = 4\sqrt{17} + (8m+8n-48)\sqrt{5} + (8mn-24m-24n+80)\sqrt{2} \ (m,n>2)$

8 $SO(C_n \times C_m) = 8mn\sqrt{2}$

9 $SO(C_n \times P_m) = 8n\sqrt{5} + (8nm-12n)\sqrt{2} \ (m>2)$

10 $SO(P_n \quad P_m) = (32mn-78m-78n+200)\sqrt{2} + 8\sqrt{34} + 4\sqrt{53} + (6m+6n-32)\sqrt{89} \ (m,n>2)$

11 $SO(C_n \quad C_m) = 32mn\sqrt{2}$

12 $SO(C_n \quad P_m) = (32mn-78n)\sqrt{2} + 6n\sqrt{89}$.

1 $v(K_n \square P_m) = mn$ $e(K_n \square P_m) = \frac{1}{2}mn^2 + \frac{1}{2}mn - n$ $K_n \square P_m$ $\delta_{K_n \square P_m} = n$

$_{K_n \square P_m} = n+1$ $n^2 - n$ $2n$

$\left(\frac{1}{2}mn^2 + \frac{1}{2}mn - n^2 - 2n\right)$ $K_n \square P_m$ Sombor

2 [7] G n k - G Sombor $SO(G) = \frac{nk^2}{\sqrt{2}}$ $K_n \square C_m$

mn $(n+1)$ - $SO(K_n \square C_m) = \frac{1}{2}nm(m+1)(n+1)\sqrt{2}$

3 $K_n \times P_m$ 10 K_n n $n-1$ -

$$SO(K_n \times P_m) = nk^2 SO(H) = n(n-1)^2\left[2\sqrt{5} + 2(m-3)\sqrt{2}\right]$$
$$= (2n^3 - 4n^2 + 2n)\sqrt{5} + (2n^3m - 4n^2m - 6n^3 + 12n^2 + 2nm - 6n)\sqrt{2} \ (m>2)$$

4 $K_n \times C_m$ mn $(2n-2)$ - $SO(K_n \times C_m) = nm(m-2)(n-1)\sqrt{2}$

5 $v(K_n \quad P_m) = mn$ $e(K_n \quad P_m) = \frac{3}{2}mn^2 - n^2 - \frac{1}{2}mn$ $K_n \quad P_m$ $\delta_{K_n \quad P_m} = 2n-1$

$_{K_n \quad P_m} = 3n-1$ $n^2 - n$ $2n^2$ $\left(\frac{3}{2}mn^2 - 4n^2 - \frac{1}{2}mn + n\right)$

$K_n \quad P_m$ Sombor

6 $K_n \quad C_m$ mn $(3n-1)$ -

$$SO(K_n \quad C_m) = \frac{1}{2}nm(3n-1)^2\sqrt{2}$$

7 $v(P_n \times P_m) = mn$ $e(P_n \times P_m) = 2(m-1)(n-1)$ $P_n \times P_m$ $\delta_{P_n \times P_m} = 1$

$_{P_n \times P_m} = 4$ 4 4 2 $(4m+4n-24)$ 2

$(2mn-6m-6n+18)$ $P_n \times P_m$ Sombor

8 $C_n \times C_m$ 10 C_n 2- $SO(C_n \times C_m) = nk^2 SO(C_m) =$
$n2^2 2m\sqrt{2} = 8mn\sqrt{2}$

9 $C_n \times P_m$ 10 C_n 2- $SO(C_n \times P_m) = nk^2 SO(P_m) =$
$n2^2\left[2\sqrt{5} + 2(m-3)\sqrt{2}\right] = 8n\sqrt{5} + (8nm-12n)\sqrt{2}$

10 $v(P_n \quad P_m) = mn$ $e(P_n \quad P_m) = 4mn - 3m - 3n + 2$ $P_n \quad P_m$ $\delta_{P_n \quad P_m} = 3$ $_{P_n \quad P_m} = 8$

8 5 4 $(2m+2n-8)$ 5

$(6m+6n-32)$ 5 $(4mn-11m-11n+30)$

$P_n \quad P_m$ Sombor

11 $C_n \quad C_m$ mn 8- $SO(C_n \quad C_m) = \frac{mn8^2}{\sqrt{2}} = 32mn\sqrt{2}$

12 $v(C_n \quad P_m) = mn$ $e(C_n \quad P_m) = 4mn - 3n$ $C_n \quad P_m$ $\delta_{C_n \quad P_m} = 5$ ${}_{C_n \quad P_m} = 8$

2n 6n $(4mn - 11n)$

$C_n \quad P_m$ Sombor

11 G $G = G_1 \quad G_2 \quad G_3 \quad G_n$

$$SO(G) > \sum_{i=1}^{n} SO(G_i)$$

$G_1, G_2, G_3, \quad , G_n$ G $G = G_1 \quad G_2 \quad G_3 \quad G_n$ $G_i (1 \le i \le n)$
$E(G_i) \neq \Phi$ $E(G) = E(G_1) + E(G_2) + E(G_3) + \quad + E(G_n)$ $G_i (1 \le i \le n)$ $v \quad V(G_i)$
$v \quad V(G)$ $d_G(v) \ge d_{G_i}(v)$ $e = uv \quad E(G_i)$ $e \quad E(G)$ G_i $d_{G_i}(u)$ G
$d_G(u)$ $d_G(u) > d_{G_i}(u)$ $\sqrt{d_G{}^2(v) + d_G{}^2(u)} > \sqrt{d_{G_i}{}^2(v) + d_{G_i}{}^2(u)}$ $E(G_i) \quad E(G)$
$SO(G) > SO(G_i)$ $E(G) = E(G_1) + E(G_2) + E(G_3) + \quad + E(G_n)$ $SO(G) > \sum_{i=1}^{n} SO(G_i)$.

1 G H

$$SO(G \quad H) > SO(G \times H) + SO(G \square H)$$

$G \quad H = (G \times H) \quad (G \square H)$ $E(G \quad H) = E(\quad)$ GH

12 WIENER H. Structural Determination of Paraffin Boiling Points J . Journal of the American Chemical Society 1947 69 01 17-20.
13 BAPAT R B GUPTA S. Resistance Distance in Wheels and Fans J . Indian Journal of Pure and Applied Mathematics 2010 41 01 1-13.
14 IMRICH W KLAVZAR S. Product Graphs Structure and Recognition M . Hoboken Wiley-Interscience Imprint 2000.
15 . D . 2011.
16 . k- D . 2019.
17 FARAHANI M R JAMIL M K KANNA M R R et al. The Wiener Index and Hosoya Polynomial of the Subdivision Graph of the Wheel S Wn and the Line Graph Subdivision Graph of the Wheel L S Wn J . Applied Mathematics 2016 6 02 21-24.

Sombor Index of Several Kinds of Product Graphs

ALIMIRE·Tuerhong MAITUROUZI·Maisidike* LIU Zhao-zhi
School of Mathematical Sciences Xinjiang Normal University Urumqi Xinjiang 830017 China

Sombor index is a new topological index based on vertex degree introduced by Gutman in Chemical Graph Theory. In this paper Sombor indices of cartesian products of path P_n with fan graph F_m and wheel graph W_m wheel graph W_n with fan graph F_m and wheel graph W_m fan graph F_n with fan graph F_m and lollipop graph $N_{a,b}$ barbell graph $D_{a,b,c}$ and kite graph $L_{a,b}$ with complete graph K_n are discussed Sombor indices of Direct products Cartesian products and Strong products of complete graph path and cycleare are also studied and the exact index values and some relations of sombor indices about product graph are obtained.

Sombor index Cartesian product Direct product Strong product

9

Bayes Estimation of the Shape Parameter of Pareto Distribution under the Gradually Increasing of Type Truncation

ZHAO Meng-ru ZHOU Ju-ling*
School of Mathematical Sciences Xinjiang Normal University Urumqi Xinjiang 830017 China

Based on gradually increasing type truncated samples. Firstly obtain the maximum likelihood estimation of the Pareto distribution shape parameter considering the two loss functions and the two prior distributions of shape parameters four Bayes estimation of the distribution shape parameter is concluded. It is found from the numerical simulation results that the mean square error of the four Bayes estimates is less than the maxi mum likelihood estimate. Among them when the loss function is a quadratic loss function and the prior distribution of the shape parameter is a conjugate prior distric ~ mz J mlfun prior dist
and the estimation effect is more ideal and the example analysis is consistent with the numerical simulation re sults. Secondly under the quadratic loss function
tion of the shape parameters
of the Pareto distribution are given.

Gradually increasing of type truncation Pareto distribution Quadratic loss Q-symmetri entropy loss Bayes estimates