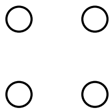
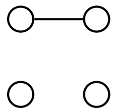
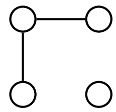
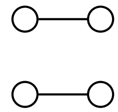
定义. 连通且无圈的无向图称为无向树，简称**树**。

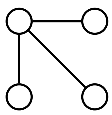
在下列具有4个顶点的互相不同构的所有无向图中，有几个为树？

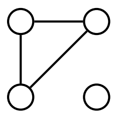

A

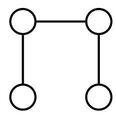

B

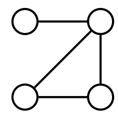

C


D


E


F


G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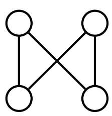
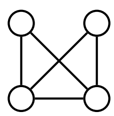
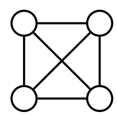
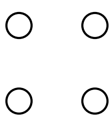

I

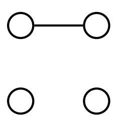

J


K

定义. 一个没有圈的无向图称为无向森林，简称**森林**。

在下列具有4个顶点的互相不同构的所有无向图中，有几个为森林？


A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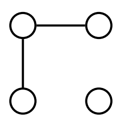
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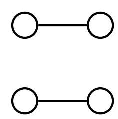
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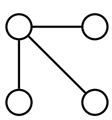
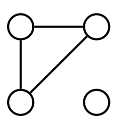
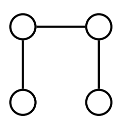

E


F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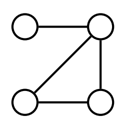
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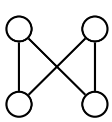
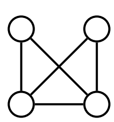
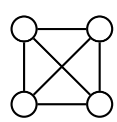
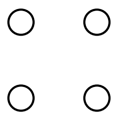

I

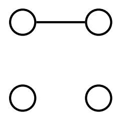

J

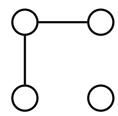

K

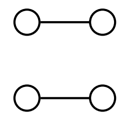
定义. 设$G = (V, E)$为一个图，G的一个生成子图$T = (V, F)$如果是树，则称T为G的**生成树**。

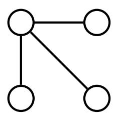
在下列具有4个顶点的互相不同构的所有无向图中，有几个无向图有一棵生成树与图E同构?

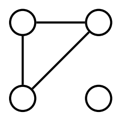

A

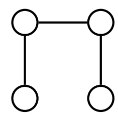

B

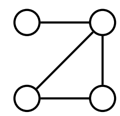

C

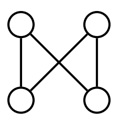

D


E


F


G


H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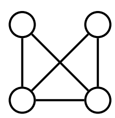
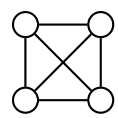
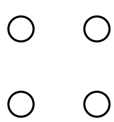
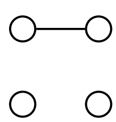

J

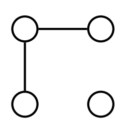

K

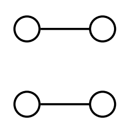
定义. 设$G = (V, E)$为一个图，G的一个生成子图$T = (V, F)$如果是树，则称T为G的**生成树**。

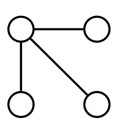
在下列具有4个顶点的互相不同构的所有无向图中，有几个无向图有一棵生成树与图G同构?

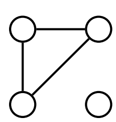

A

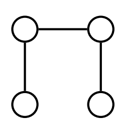

B

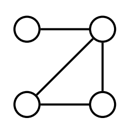

C

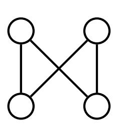

D


E


F


G


H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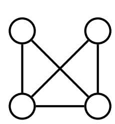
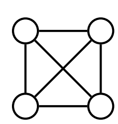
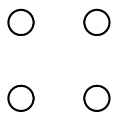
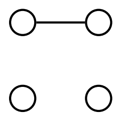
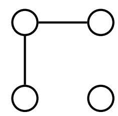

J


K

定义. 设v为图G的一个顶点，如果$G-v$的支数大于G的支数，则称顶点v为图G的一个**割点**。

在下列具有4个顶点的互相不同构的所有无向图中，有几个图有且仅有两个割点?


A

B

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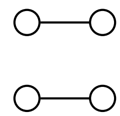
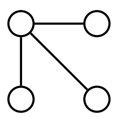
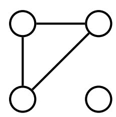
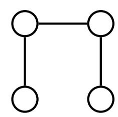
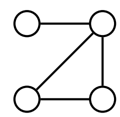
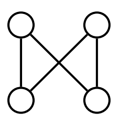

D


E

F

G

H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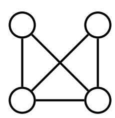
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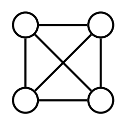
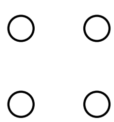
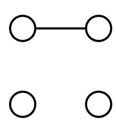
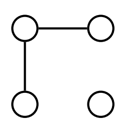
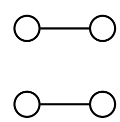
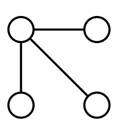
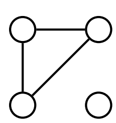
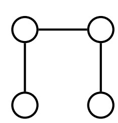
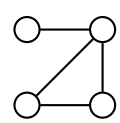
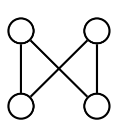
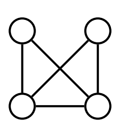
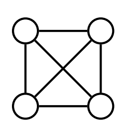

K

定义. 图G的一条边x称为G的一座**桥**，如果$G-x$的支数大于G的支数。

在下列具有4个顶点的互相不同构的所有无向图中，有几个无向图有且仅有两条割边?


A

B

C

D


E

F

G

H

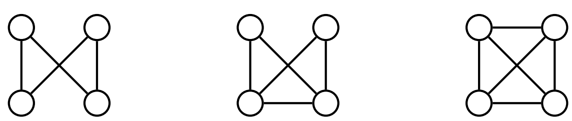

I

J

K

定义. 设$G=(V,E)$为图，$S\subseteq E$。如果从G中去掉S中的所有边得到的图$G-S$的支数大于G的支数，而去掉S的任一真子集中的边得到的图的支数不大于G的支数，则称S为G的一个**割集**。

在下列具有4个顶点的互相不同构的所有无向图中，图H有几个互不相同的割集?

A B C D

E F G H



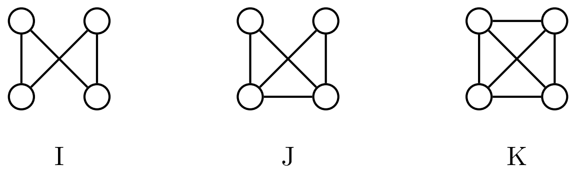
I J K

定义. 图G的**顶点连通度**是指为了产生一个不连通图或平凡图所需要从G中去掉的最少顶点数目，记为$\kappa(G)$。

在下列具有4个顶点的互相不同构的所有无向图中，有几个顶点连通度为2?

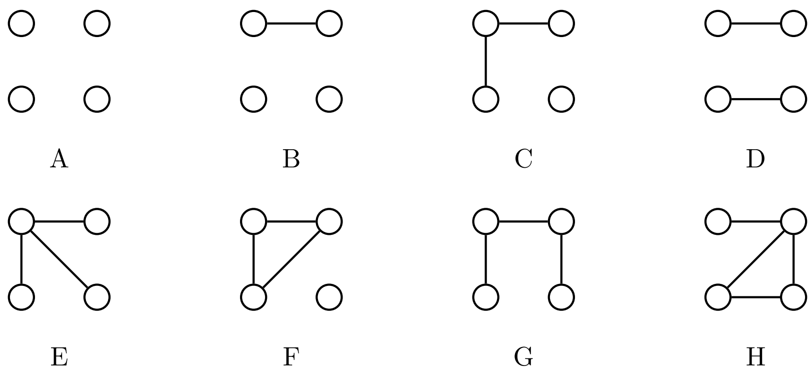
A B C D

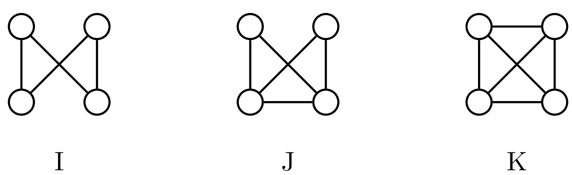
E F G H



定义. 图G的**边连通度**是指为了产生一个不连通图或平凡图所需要从G中去掉的最少边的数目, 记为$\lambda(G)$。

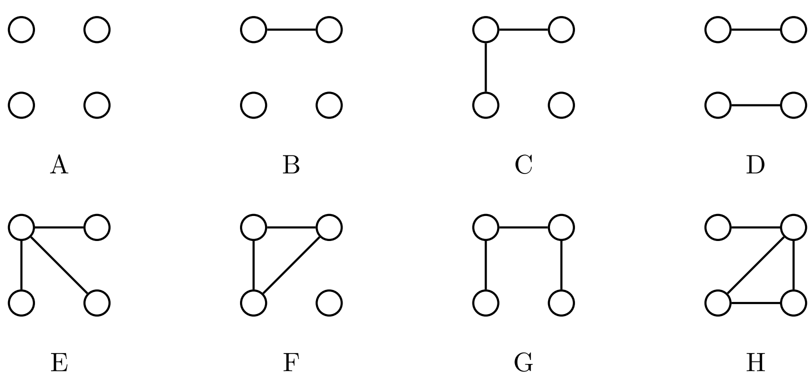
在下列具有4个顶点的互相不同构的所有无向图中，有几个边连通度为2?

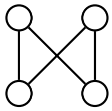




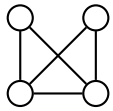
定义. 设G为一个图，如果$\kappa(G) \geq n$，则称G为n**-顶点连通**的，简称n-连通。

在下列具有4个顶点的互相不同构的所有无向图中，有几个为1−连通的无向图?

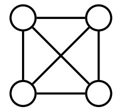




I



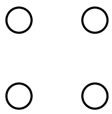
J



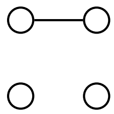
K

定义. 设G为一个图，如果$\lambda(G) \geq n$，则称G为n**-边连通**的。

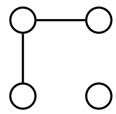
在下列具有4个顶点的互相不同构的所有无向图中，有几个为1边连通的无向图?



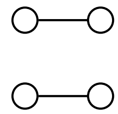
A



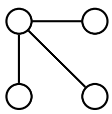
B



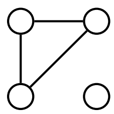
C



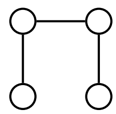
D



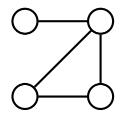
E



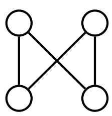
F



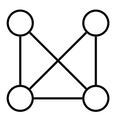
G



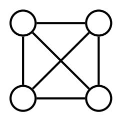
H



I

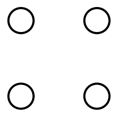


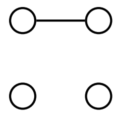
J

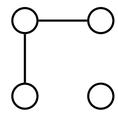


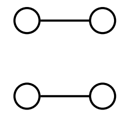
K

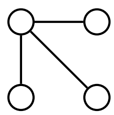
在下列具有4个顶点的互相不同构的所有无向图中，有几个具有完全匹配的偶图？

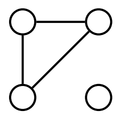

A

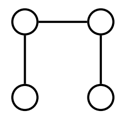

B

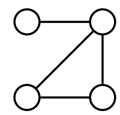

C

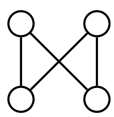

D

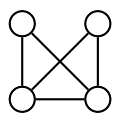

E

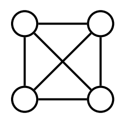

F


G


H


I

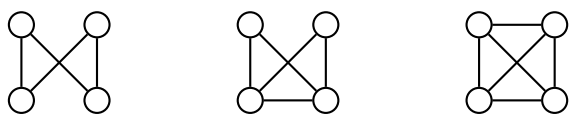

J


K

在下列具有4个顶点的互相不同构的所有无向图中，有几个具有完美匹配的无向图?

A B C D

E F G H



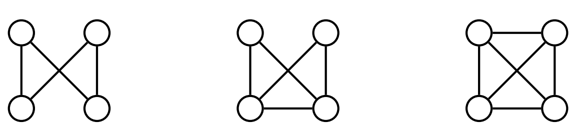
I J K

定义. 图G称为被嵌入平面S内，如果G的图解已画在S上，而且任意两条边均不相交（除可能在端点相交外）。 已嵌入平面内的图称为**平面图**。如果一个图可以嵌入平面，则称此图为**可平面的**。

在下列具有4个顶点的互相不同构的所有无向图中，有几个可平面的无向图?

A B C D

E F G H

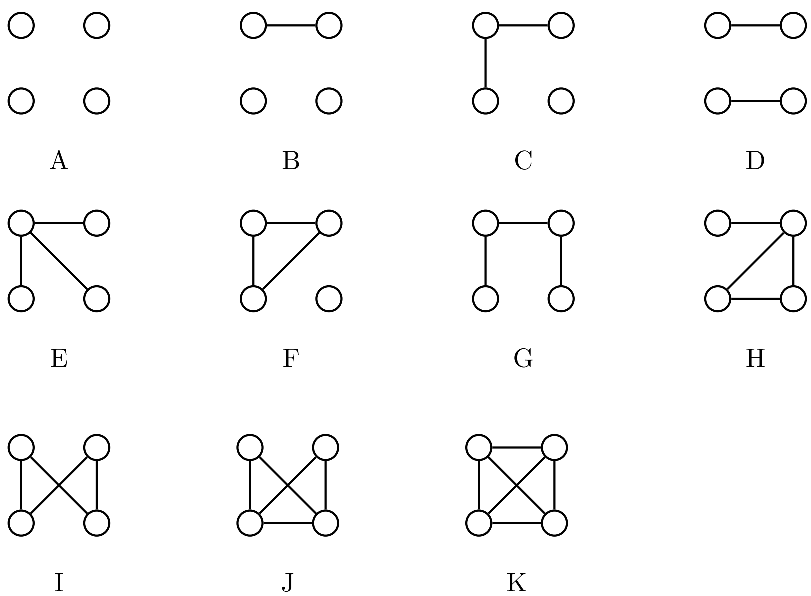


I J K

定义. 图的一种**着色**是指对图的每个顶点指定一种颜色，使得没有两个临接的顶点有同一种颜色。图G的一个$n-$**着色**是用n种颜色对G的着色。

定义. 图G的**色数**是使G为$n-$着色的数n的最小值，图G的色数记为$\chi(G)$。若$\chi(G) \leq n$，则称G为$n-$**可着色**的。若$\chi(G) = n$，则称G为n**色**的。

在下列具有4个顶点的互相不同构的所有无向图中，有几个图的色数为3?



定义. 设$D=(V,A)$为一个有向图。D的一条**有向通道**为D的顶点和弧的一个交错序列

$$v_0, x_1, v_1, x_2, v_2, \cdots, v_{n-1}, x_n, v_n$$

其中$x_i=(v_{i-1},v_i)$， $i=1,2,\cdots,n$。n称为该有向通道的长。 这样的有向通道常称为v_0-v_n有向通道，并简记为$v_0v_1v_2\dots v_n$。如果有向通道的长大于等于1且$v_0=v_n$,则称此有向通道为**闭有向通道**。

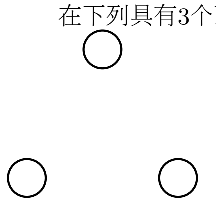
定义. 如果有向图中一条有向通道的各弧互不相同，则称此有向通道为有向图的**有向迹**。如果一条闭有向通道上的各弧互不相同，则称此闭有向通道为**闭有向迹**。

定义. 如果一条有向迹上的各顶点互不相同，则称此有向迹为**有向路**。如果闭有向迹上除终点外各顶点互不相同，则称此闭有向迹为**有向圈**。

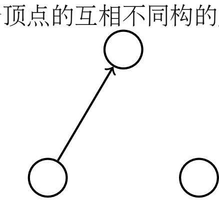
定义. 设$D=(V,A)$为一个有向图，u和v为D的顶点。如果在D中有一条从u到v的有向路，则称从u可以达到v，或者v是从u**可达**的。

定义. 有向图D称为是**强连通**的，如果对D的任意两个不同的顶点u和v，u和v是互达的（即从u可以达到v并且从v可以达到u）。

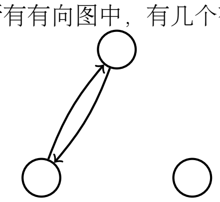
在下列具有3个顶点的互相不同构的所有有向图中，有几个有向图是强连通的?



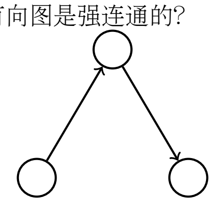
A



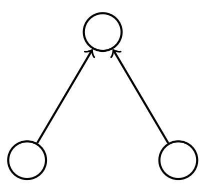
B



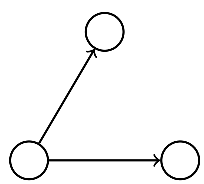
C



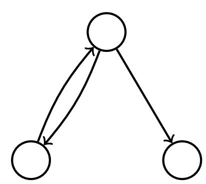
D



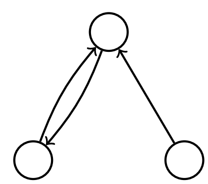
E



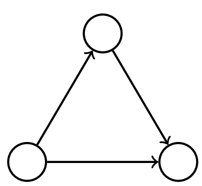
F



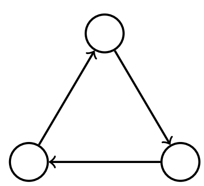
G



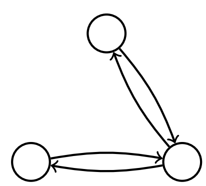
H



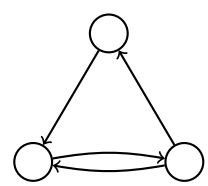
I



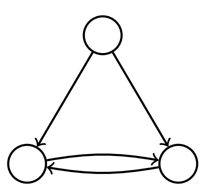
J



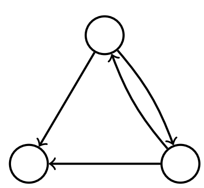
K



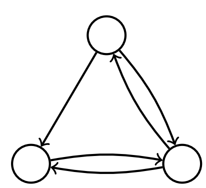
L



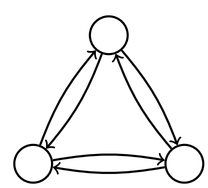
M



N



O



P

定义. 设$G = (V, E)$为一个图，G的任意两条不邻接的边x与y称为互相**独立**的边。

定义. 图G的边集E的子集Y称为G的一个**匹配**，如果Y中任意两条不同的边都是互相独立的。

定义. 设Y为图$G = (V, E)$的一个匹配，如果对于G的任一匹配Y'，恒有$|Y'| \leq |Y|$, 则称Y为G的一个**最大匹配**。

设无向图G的邻接矩阵如下：

$$\begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

则G的最大匹配中包含多少条边?

A. 1
B. 2
C. 3
D. 4