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Proof of four-color theorem of normal map

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ABSTRACT. *The four-color theorem, each map without enclaves can be colored with no more than four colors, but adjacent areas have different colors. In order to prove the four color theorem, I introduced a new concept primitive, base, power half ring, quotes the definition of kemp normal map and the other a conclusion: as long as proof of a normal map satisfy the four-color theorem, the other is normal maps and map is a map of meet the four-color theorem, namely he needed any so-called informal map to color generally smaller than the normal map.*

KEYWORDS: *The four-color theorem; normal map; primitive*

1. Introduction

Problem: No more than four colors can be used on any map to make two neighboring countries different colors.

Regular map: a country does not contain another country, or does not have more than three countries adjacent to each other.

2. Certification

Definition: primitives, as shown in FIG. E as the core, A, C, G, and I as the apex, and B, F, D, and H as the middle.

A base element must have a core, either at the top or in the base.

Standard primitives: four bases, one of four bases, and one center.

Fig (1) is an abstract element of Fig (2). Any primitive of any type has a primordial image, that is, the corresponding map position, and the primitive is the image of a map.

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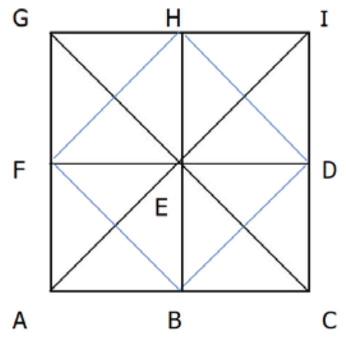


Figure 1 Primitive

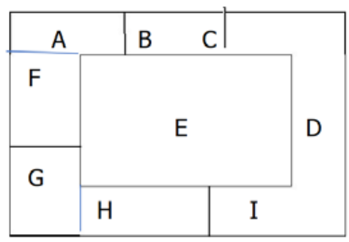
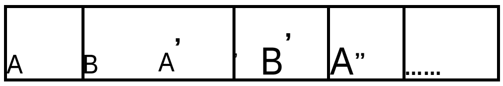


Figure 2 The original sample

1) The map is the original image

(1) Line segment chain map (not connected end to end)



$Point_{A(2n-1)}$={A, A', A''……}=Color(C_1), for C_1.($n \in [1,+\infty]$)

$Point_{B(2n)}$={B, B', B''……}=Color(C_2), for C_2.($n \in [1,+\infty]$)

Line LinkAB={C_1,C_2,C_1,C_2……}=Color(C_1,C_2);

Property 1: No matter the odd or even number of countries, the countries of line segment chain need to be filled with two colors.

(2) Circular map

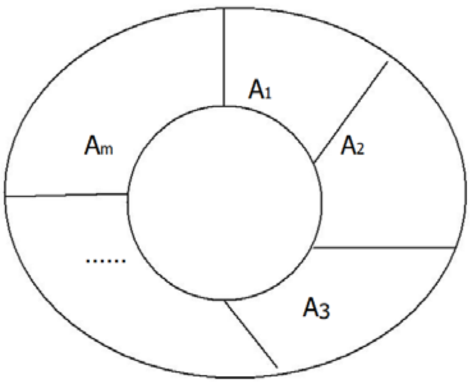


Figure 3 Circular map

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When m=2n+1, CircleA={A1,A2,A3...

Am} = Color (C1, C2 and C3) = {C1 and C2, C1 and C2, C1, C2...

C3}

When m=2n, CircleA={A1,A2,A3...Am} = Color (C1, C2) = {C1 and C2, C1 and C2, C1, C2...C2}

Property 2: If the chain is odd number of countries, three colors are needed; if the chain is even number of countries, two colors are needed.

A circular chain can be thought of as a chain of multiple segments.

(3) Semicircle chain: a circular chain that is not connected end to end.

Property 3: Half loop chain can be considered as a special line segment chain, so the required color is also two, denoated as Pcircle.

2) (1) It is assumed that the top and the base are composed of cyclic chains. No matter the standard primitives or non-standard primitives, according to property 2, the secondary cyclic chains need at most three colors and at least two colors.

The color of the base is different from the color of the ring chain in the countries surrounding it, so the base element needs a maximum of four colors and a minimum of three colors.

Its corresponding map image requires a maximum of four colors and a minimum of three.

Description: As shown in FIG. 1, LinkAB represents A line segment chain, not necessarily two countries, country A and country B, but also countries A, B, A1, B1...A line chain consisting of several countries.

(2) In a primitive, there is a blank area around the basic center, that is, a hollow point, and there is no annular chain, that is, a graph composed of all line segment chains or line segment chains and half ring chains. How many colors are needed to fill in the color?

According to property 3, we know that the half-ring chain is a special line segment chain, and according to property 1, the colors required are two colors.

In addition, the base center is different from the color around it, so the basic elements of this structure need 3 colors, so the corresponding image map is also 3 colors.

3) Base group: The graph composed of 9 adjacent primitives is called a base group, as shown in Figure 3 below. A base group can be regarded as a primitive, and a primitive in each base group can be regarded as a point in the primitive.

(1) When each of the 9 primitives is surrounded by a ring chain, the core is in a closed space, so there is a common line segment chain or a half-ring chain adjacent to the primitive. Fill in the color of a ring chain first, and alternately fill in the color from the end of the common chain of adjacent primitives.

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Therefore, under this kind of structure, the color of all loop chain should not exceed 3, and the base color should not exceed 4 at most.

Therefore, the base group of this structure corresponds to no more than 4 colors on the map.

(2) If the base center of one or more primitives in the base group is composed of multiple line segment chains or half-ring chains, how many colors are required at least in this case.

(I) Consider that the base center of an adjacent primitive is not adjacent to the base center

Max Num = {Link (Xn)} {Color (C1, C2)} = 2;

Max {Link} (X 'n) Num = {Color (C1, C2)} = 2;

....

Whether the chains are adjacent or intersecting or not, you need three colors in addition to the different colors of the base.

(ii) Consider adjacent one or several base centers

It is assumed that there are multiple base centers connected. Since the normal map has at most three countries adjacent to each other, the three base centers form a ring chain and their colors are at most 3. The multiple ring chains form a long line segment chain with alternating colors, so the three colors are needed at most.

Color (E1) = C1, Color = C2 (E2), Color (E3) = C3,

Heart Hear (E1) studying Hear (E2) = Link (E1 and E2) = Color (C1, C2);

Not_Heart(E1,E2)_Belong(E1)= Color(C3,C4);

So at most 4 medium colors.

Conclusion: The basic group satisfies the four-color theorem, so the map of the original image corresponding to the basic group also satisfies the four-color determination.

4) Let's try another way to prove that a base group requires at most four colors.

We will base a primitive as a point in the element, the element with the mixed color of 4 kinds of color, will be mixed as a kind of color of color, this group into chengji structure, adjacent points element and element, want to have different color samples, as long as part of the vision of their border color, namely take in mixed color, a color.

Since a primitive needs at most 4 colors, the number of colors needed by the primitive structure converted from the basic group is no more than 4, so the number of colors needed by the basic group is also at most 4. Over.

5) Based on the above discussion, a normal map can be transformed into a graph of a 9N model composed of multiple primitions. The following assumption can be

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made for this model, which requires no more than 4 colors.

Will be $9^n \rightarrow 9^{n-1} \rightarrow 9^{n-2} \rightarrow 9^{n-3} \rightarrow \ldots\ldots \rightarrow 9^2 \rightarrow 9$, prove the above process 4 ideas. To complete.

We can then derive the following theoretical model

6) Set S = $\{9^n \mid n \geq 0\}$,

(1) Obviously, (S,+),+ means multiplication, is a idyl semigroup, a commutative semigroup.

Proof: (I) suppose a,b,c∈S, because (ab)c=a(BC), satisfies the associative law

(ii) When E =1 and ea= AE, there is a unit element.

(iii) Because S0 =90, S1 =91, S2 =92, S3 =93...., 9 is idempotent.

(iv) because ab is equal to ba, satisfies the commutative law

Never put off till tomorrow what you can.

(2) We are giving S another operation (S,o), which satisfies the operation A, B ∈S,a o b = 9. Such a semigroup belongs to monoid and commutative semigroup.

Proof: (I) set a,b,c∈S because (a o b) o c= 9 o c= 9, a o (b o c) = a o 9 =9; (b o c) = a o 9 =9.

A, o, b, o, c is equal to A, o, b, o, c, so that satisfies the associative law

(ii) When e=1,, makes, exists the unit element.

(iii) A, o, b = 9 = B, o, A, satisfies the commutative law.

Never put off till tomorrow what you can.

(3) Let's look at the properties of semigroups that have this property.

Property (I): Any element (except 1) of this semigroup can be regarded as or converted into an idempotent structure (such as the transformation of 5 above).

Properties (II): Any element has the properties of idempotent elements. For example, primitives have no more than four colors, so other elements have no more than four colors.

Property (III): Any of its subsemigroups has idempotent properties.

We can generalize this, and this leads to the following new concepts and properties

7) Idyl half ring

Definition: suppose S={mn},S has two kinds of algebraic operations, denoting as (S,+,o), which satisfy the following operations, and + represents multiplication operation,

(I) A, B, C ∈S, A o b = m;

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(II) (a + b) + c = A + (b + c);

(III) $\exists e \in S$, make a + e = E + A;

(IV) S0 = M0, S1 = M1, S2 =m2, S3 =m3....There are idempotent elements

(V) A+B = B+A

(VI) (a o b) (o c) = A o (b o c)

(VII) $\exists e \in S$, making $\forall a \in S, a \circ e = e \circ a$

(VIII) A o B = B o A;

8) Properties of idyllic semiring:

(I)(S,+) is a idyllic and commutative semigroup, and has the properties of idyllic and commutative semigroups.

(II)(S, O) is a monoid, a commutative semigroup, having a monoid and a commutative semigroup.

(III) Any element (except 1) in a semicircle can be regarded as or converted into an idempotent structure

(IV) Any element has the properties of idempotent elements

(V) Any of its subsemigroups has idempotent properties

3. Conclusion

Normal maps can be converted into idyllic semidyclic rings with no more than 4 colors required, so the four-color theorem is valid.

References

[1] Kempe A B. On the Geographical Problem of the Four Colours[J]. American Journal of Mathematics, 1879, 2(3), page: 193-200.