① Equating RZF & IZF - Rederived 24/10/2014

**29** March Saturday 29-03-2014

$$\frac{Z_1(s)\det(I - Aq_1^{-s} + q_1^{1-2s} I)}{(1+q^{-s})^{|V|-|E|}} = (1-q^{-s})^{|V|-|E|}$$

$\Rightarrow$

$$\frac{\left(Z_1(s)\det(I - Aq_1^{-s} + q_1^{1-2s} I)\right)^{\frac{1}{|V|-|E|}}}{(1+q_1^{-s})^{\frac{|V|-|E|}{|V|-|E|}}} = (1-q^{-s})$$

$$\frac{(1+q_1^{-s})}{Z_1(s)\det(I - Aq_1^{-s} + q_1^{1-2s} I)^{\frac{1}{|V|-|E|}}} = \frac{1}{(1-q_1^{-s})}$$

For all prime regular graph products in LHS = RZF

30 Sunday

Amavasya, 30-03-2014

$$\frac{(1+q_1^{-s})(1+q_2^{-s})\cdots}{Z_1(s)Z_2(s)\cdots(I - Aq_1^{-s} + q_1^{1-2s} I)^{\frac{1}{|V|-|E|}}(I - Aq_2^{-s} + q_2^{1-2s} I)^{\frac{1}{|V|-|E|}}\ \vdots} = RZF = \frac{1}{(1-q_1^{-s})}\frac{1}{(1-q_2^{-s})}\cdots$$

If RHS = 0

then $(1+q_1^{-s})(1+q_2^{-s})\cdots$

$= 0$

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$s = a+ib$ is a zero of RZF in RHS. ②

31-03-2014

Telugu New Year's Day

March Monday **31**

$\Rightarrow$ for some $s$ and some prime $q_t$

$$(1+q_t^{-s}) = 0$$

$$-1 = q_t^{-s}$$

$$q_t^{s} = -1$$

$$q^{a+ib} = -1$$

$$q^{a} q^{ib} = -1$$

$$q^{ib} = \frac{-1}{q^a}$$

$$e^{ib\log q} = \frac{-1}{q^a}$$

$$\cos(b\log q) + i\sin(b\log q) = \frac{-1}{q^a}$$

$Im()$:

$$b\log q + n\pi = 0$$

$$\cos(b\log q) = \frac{-1}{q^a}$$

$$\frac{(2n+1)\pi}{2}$$

$$n\pi = -b\log q$$

$$n = \frac{-b\log q}{\pi}$$

$$\cos\left(\cancel{b\log q} - \frac{b\log q}{2}\right) = \frac{-1}{q^a}$$

$$\cos\left(\frac{b\log q}{2}\right) = \frac{-1}{q^a}$$

$$\cos\left(b\log q + (2n+1)\frac{\pi}{2}\right) = \frac{-1}{q^a}$$

$$\cos\left(b\log q + \left(\frac{-2b\log q}{\pi} \times \frac{\pi}{2} + \frac{\pi}{2}\right)\right)$$

$$\cos\frac{\pi}{2} = \frac{-1}{q^a}$$

$$\frac{-1}{q^a} = 0$$

$$q^a = \infty$$

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Continued from $\boxed{31/3/2014}$ ③

**3** April Thursday 03-04-2014 ★ Kritikai

$$b\log q + n\pi = 0$$

$$\frac{b\log q}{\pi} = -n$$

$$\cos\left(b\log q + (2n+1)\frac{\pi}{2}\right) = \frac{-1}{q^a}$$

$$\cos\left(b\log q + \left(\frac{2b\log q}{\pi}+1\right)\frac{\pi}{2}\right) = \frac{-1}{q^a}$$

$$\cos\left(b\log q \cancel{-} b\log q + \frac{\pi}{2}\right) = \frac{-1}{q^a}$$

$$\cos\left(\frac{\pi}{2}\right) = \frac{-1}{q^a}$$

$$0 = \frac{-1}{q^a} \qquad \boxed{q^a = \infty}$$

$\Rightarrow a = \infty$

If denominator is infinity

$$\left[Z_1 Z_2 \ldots \det()\det()\ldots\right]^{\frac{1}{|V|-|E|}} = \infty$$

or $\left[Z_1 Z_2 \ldots \det()\det()\ldots\right]^{\frac{1}{|E|-|V|}} = 0$

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④

04-04-2014 April Friday **4**

$\Rightarrow Z_1 Z_2 \ldots \det()\det()\ldots$

$\boxed{25/10/2014}$ If RH is true:

$$q^{ib} \le \frac{\sqrt{q} \pm \sqrt{q-4}}{2}$$ for some $q$-regular graph ($q$ prime)

$$e^{ib\log q} \le \frac{\sqrt{q} \pm \sqrt{q-4}}{2}$$

$$\cos b\log q + i\sin b\log q \le \frac{\sqrt{q} \pm \sqrt{q-4}}{2}$$

$$\sin(b\log q + n\pi) = 0$$

$$b\log q = -n\pi$$

$$n = \frac{-b\log q}{\pi}$$

$$\cos\left(b\log q + (2n+1)\frac{\pi}{2}\right) \le \frac{\sqrt{q} \pm \sqrt{q-4}}{2}$$

$$\cos\left(b\log q + \left(\frac{-2b\log q}{\pi} \times \frac{\pi}{2} + \frac{\pi}{2}\right)\right) \le \frac{\sqrt{q} \pm \sqrt{q-4}}{2}$$

$$\cos\left(\frac{\pi}{2}\right) \le \frac{\sqrt{q} \pm \sqrt{q-4}}{2}$$

$$0 \le \frac{\sqrt{q} \pm \sqrt{q-4}}{2}$$

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(5)

$$q^{a+ib} \leq \frac{q \pm \sqrt{q^2-4q}}{2}$$

$$q^{a+ib} \leq \frac{\sqrt{q}(\sqrt{q}) \pm \sqrt{q(q-4)}}{2}$$

$$q^{a+ib} \leq \frac{\sqrt{q}\left(\sqrt{q} \pm \sqrt{q-4}\right)}{2}$$

$$\frac{q^{a+ib}}{q^{1/2}} \leq \frac{\sqrt{q} \pm \sqrt{q-4}}{2}$$

$$q^{a-\frac{1}{2}+ib} \leq \frac{\sqrt{q} \pm \sqrt{q-4}}{2}$$



$$\left(a-\frac{1}{2}+ib\right)\log q \leq \log\left(\frac{\sqrt{q} \pm \sqrt{q-4}}{2}\right)$$

$$\left(a-\frac{1}{2}+ib\right) \leq \frac{\log\left(\sqrt{q} \pm \sqrt{q-4}/2\right)}{\cancel{2}\log q}$$

~~RHS (Im()) = a < 1/2~~

~~$a < 1/2$~~ For $q < 4$ $(2, 3)$ above has imaginary part





$\boxed{q=2}$

(6)

~~$a+\frac{1}{2}+ib \leq \frac{\sqrt{q} \pm \sqrt{q+4}}{2\log q}$~~

~~$\leq \frac{\sqrt{2} \pm i\sqrt{2}}{2\log 2}$~~

$$\left(a-\frac{1}{2}+ib\right)\log q \leq \log\left[\frac{\sqrt{q} \pm \sqrt{q-4}}{2}\right]$$

$$a-\frac{1}{2}+ib \leq \frac{\log\left(\frac{\sqrt{q} \pm \sqrt{q-4}}{2}\right)}{\log q}$$

$\boxed{\text{if } q=2}$ :

$$a-\frac{1}{2}+ib \leq \frac{\log_2\left(\frac{\sqrt{2} \pm i\sqrt{2}}{2}\right)}{\log_2 2}$$

$$\boxed{a-\frac{1}{2}+ib \leq \log\left(\frac{1 \pm i}{\sqrt{2}}\right)}$$

$\boxed{\text{if } q=3}$ :

$$\boxed{a-\frac{1}{2}+ib \leq \frac{\log\left(\frac{\sqrt{3} \pm i}{2}\right)}{\log 3}}$$





(7)

For $q \geq 5$

$$a-\frac{1}{2}+ib \leq \frac{\log\left[\frac{\sqrt{q} \pm \sqrt{q-4}}{2}\right]}{\log q}$$

$$a-\frac{1}{2} \leq \frac{\log\left[\frac{\sqrt{q} \pm \sqrt{q-4}}{2}\right]}{\log q}$$

$$a \leq \frac{\log\left[\frac{\sqrt{q} \pm \sqrt{q-4}}{2}\right]}{\log q} + \frac{1}{2}$$

$$q^s + q^{1-s} \leq q$$

$$q^s + \frac{q}{q^s} \leq q$$

$$q^{2s} + q \leq q^{s+1}$$

$$q^{2s} + q - q^{s+1} \leq 0$$





(8) (%) Re-Re ~~derived~~ differently [25/10/2014 12:45 p.m

$$q^{2a+2ib} + q - q^{a+1+ib} \leq 0$$

$$e^{(2a+2ib)\log q} + q - e^{(a+1+ib)\log q} \leq 0$$

$$e^{2a\log q} \times e^{2ib\log q} + q - e^{(a+1)\log q} \times e^{ib\log q} \leq 0$$

$$\boxed{\begin{aligned} &e^{2a\log q}\left(\cos(2b\log q) + i\sin(2b\log q)\right) + \\ &q + \\ &e^{(a+1)\log q}\left(\cos b\log q + i\sin b\log q\right) \leq 0 \end{aligned}}$$

Re()

$$e^{2a\log q}\cos(2b\log q) + q + e^{(a+1)\log q}\cos b\log q \leq 0 \quad \text{—(1)}$$

Im()

$$e^{2a\log q}\sin(2b\log q) + e^{(a+1)\log q}\sin b\log q \leq 0 \quad \text{—(2)}$$

Removing e;

Re()

$$q^{2a}\cos(2b\log q) + q + q^{(a+1)}\cos b\log q \leq 0$$

Im()

$$q^{2a}\sin(2b\log q) + q^{(a+1)}\sin b\log q \leq 0$$

Dividing Real and Imaginary. (9)

10-04-2014

10 April Thursday

$$q^{2a}\sin(2b\log q) = -q^{(a+1)}\sin b\log q$$

$$q^{2a}\cos(2b\log q)+q = -q^{(a+1)}\cos b\log q$$

$$\boxed{\frac{q^{2a}\sin(2b\log q)}{q^{2a}\cos(2b\log q)+q} = \tan b\log q} \quad \text{— (3)}$$

if RH is true $a=\frac{1}{2}$ for all $s=a+ib$

From (3) $q^{2a}=q$

$$\boxed{\frac{q\sin(2b\log q)}{q\cos(2b\log q)+q} = \tan b\log q} \quad \text{— (4)}$$

$$\boxed{\frac{\sin(2b\log q)}{\cos(2b\log q)+1} = \tan b\log q} \quad \text{— (5)}$$

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$$e^{ix} = \cos x + i\sin x \quad (10)$$

11-04-2014

April Friday 11

$$e^{ix}\times e^{ix} = (\cos x + i\sin x)^2$$

$$e^{i2x} = \cos^2 x + 2i\sin x\cos x + \sin^2 x$$

$$\cos 2x + i\sin 2x = \cos^2 x - \sin^2 x + i(2\sin x\cos x)$$

$$\sin 2x = 2\sin x\cos x$$

$$\sin(2b\log q) = 2\sin(b\log q)\cos(b\log q)$$

$$\cos(2b\log q) = \cos^2 b\log q - \sin^2 b\log q$$

From (5)

$$\frac{2\sin(b\log q)\cos(b\log q)}{\cos^2 b\log q - \sin^2 b\log q + 1} = \tan b\log q = \frac{\sin b\log q}{\cos b\log q} \quad \text{— (6)}$$

$$\frac{2\cos(b\log q)}{\cos^2 b\log q - \sin^2 b\log q + 1} = \frac{1}{\cos b\log q} \quad (7)$$

$$\frac{2\cos^2(b\log q)}{\cos^2 b\log q + \cos^2 b\log q}$$

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(11)

12-04-2014

12 April Saturday

$$\frac{2\cos^2(b\log q)}{2\cos^2(b\log q)} = 1$$

$\Rightarrow a=\frac{1}{2}$ for all $s=a+ib$

from $\det(I - Aq^{-s} + q^{1-2s} I) = 0$

and using $q^s + q^{1-s} \le q$

(or) $q^{2s} + q - q^{s+1} \le 0$

$\boxed{\text{Pages 8, 9, 10, 11}}$ 9/4/2014 to 12/4/2014

Ka. Shrinivaasan.

Assumption of $a=\frac{1}{2}$ for all $s=a+ib$ (non-Ramanujan graphs) doesn't give any contradiction.

13 Sunday

Mahaveer Jayanthi, 13-04-2014

Ramanujan graphs have RZF as zeros

for $a\neq\frac{1}{2}$ · $\frac{q^{2a}\sin(2b\log q)}{q^{2a}\cos(2b\log q)+q}$

would not be equal to RHS as $q$ would not be common in num & denom

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For numerator product $= 0$. (12)

(page 1 29/3/2014)

14-04-2014

Tamil New Year's Day, Dr.Ambedkar Jayanthi, Pournami

April Monday 14

$1+q^{-s} = 0$ for some $s=a+ib$

when RZF in RHS is zero.

$$q^{-s} = -1$$

$$q^{s} = -1$$

$$q^{a+ib} = -1$$

$$e^{(a+ib)\log q} = -1$$

$$e^{a\log q}\times e^{ib\log q} = -1$$

$$e^{a\log q}(\cos b\log q + i\sin b\log q) = -1$$

$$e^{a\log q}\cos b\log q = -1$$

$$e^{a\log q}\sin b\log q = 0$$

$$\tan b\log q = 0$$

$\Rightarrow b=0$ or $\log q = 0$ both are incorrect. Thus numerator never vanishes.

May 2014

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15 April Tuesday

15-04-2014

○ Pournami

Thus denominator product of (13)

Ihara identities for all prime regular graphs $\exists \infty$ and only $a = \frac{1}{2}$ satisfies it for non-ramanujan graphs. Thus Riemann Hypothesis is TRUE (or is it?)

K. Shrinivasan

25/10/2014 1pm.

March 2014

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16-04-2014

April Wednesday 16

May 2014

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25 March Tuesday

25-03-2014

$$RZF = \left[ \frac{\left(Z_1 \times \det(I - A q_1^{-s} + q_1^{1-2s} I\right)}{\left(1 + q_1^{-s}\right)} * \frac{\left(Z_2 \times \det\left(I - A q_2^{-s} + q_2^{1-2s} I\right)\right)}{\left(1 + q_2^{-s}\right)} * \right]^{\frac{|V| - |E|}{|E| - |V|}}$$

If $|V| > |E|$

Number of edges of a $q$ regular graph is

$$\frac{|V| \times (|V| - 1)}{2}$$

$$V \begin{bmatrix} q^{1's} \\ q^{1's} \\ q^{1's} \\ \end{bmatrix}$$

$$|E| = |V| \times q - \left[ |V| + \right]$$

~~Regular~~

$q$-regular graph ~~of~~ with $|V|$ vertices is of size $(|E|)$ $\frac{q|V|}{2} = |E|$ (Handshake Lemma)

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$$\frac{q|V|}{2} = |E|$$

26-03-2014

March Wednesday 26

$$|E| - |V| = \frac{q|V|}{2} - |V|$$

$$|E| - |V| = |V|\left(\frac{q-2}{2}\right) = \frac{|V|(q-2)}{2} = |E| - |V|$$

$$\frac{|V| - |E|}{|E| - |V|} = -1$$

$RZF = 0 \Rightarrow RHS = \infty$

(or) $$\frac{Z_1 Z_2 \ldots \det(\,)\det(\,)\ldots}{\left(1 + q_1^{-s}\right)\left(1 + q_2^{-s}\right)\ldots} = \frac{1}{0}$$

$$\Rightarrow \left(1 + q_1^{-s}\right)\left(1 + q_2^{-s}\right) \ldots = 0$$

$$\Rightarrow \boxed{\left(1 + \frac{1}{2^s}\right)\left(1 + \frac{1}{3^s}\right)\left(1 + \frac{1}{5^s}\right) \ldots = 0 \; ?}$$

$\Rightarrow$ for some $q_t$, $1 + \frac{1}{q_t^s} = 0$

(or) $$-1 = \frac{1}{q_t^s}$$

$$q_t^s = -1$$

$$q^a q^{ib} = -1 = i^2 = e^{i\pi}$$

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$$q^a q^{ib} = e^{i\pi}$$



$\boxed{\text{if for all } s = a+ib \quad a = 1/2,}$

$$\sqrt{q}\, q^{ib} = e^{i\pi}$$

$$\sqrt{q}\, e^{ib\log q} = e^{i\pi}$$

$$\Rightarrow \sqrt{q} = e^{i(\pi - b\log q)}$$

$$\sqrt{q} = \cos(\pi - b\log q) + i\sin(\pi - b\log q)$$

$$\Rightarrow \sqrt{q} = \cos(\pi - b\log q)$$

$$0 = \sin(\pi - b\log q)$$

(or) $\dfrac{\pi}{b} = \log q$ again some contradiction if $a = 1/2$ for all $s = a+ib$

if $a \neq 1/2$ for some $s = a+ib$

$$q^a = e^{i\pi} \times e^{-ib\log q}$$

$$q^a = e^{i(\pi - b\log q)}$$

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$$q^a = \cos(\pi - b\log q) + i\sin(\pi - b\log q).$$

$$q^a q^{ib} = -1$$

$$q^{ib} = -q^{-a}$$

$$e^{ib\log q} = -q^{-a}$$

$$\cos b\log q + i\sin b\log q = -q^{-a}$$

$$\cos b\log q = -q^{-a}$$

$$\log \cos b\log q = -a\log(-q).$$

$$\boxed{-\frac{\log(\cos(b\log q))}{\log(-q)} = a}$$

if $a = 1/2$ for all $s = a+ib$

$$-\frac{\log(\cos(b\log q))}{\log(-q)} = \frac{1}{2}$$

$$\log(-q) = -2\log(\cos(b\log q))$$

$$+q = -\cos(b\log q)^{-2}$$

$$q = \frac{-1}{[\cos(b\log q)]^2}$$

$$\cos b\log q = \sqrt{\frac{-1}{q}}$$

$$\cos b\log q = \frac{i}{\sqrt{q}}$$

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