Subtopic

Topic #

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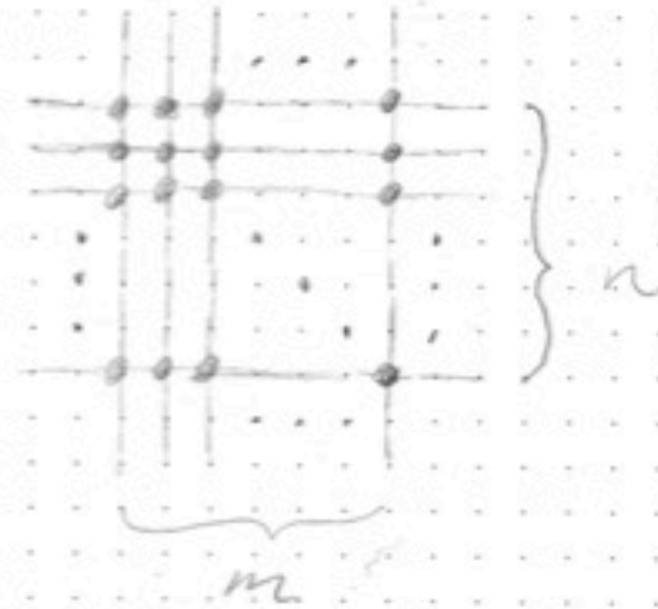
PG #.

$G(V, E)$



$V := \{ [x]_m \cap [y]_n \mid (x,y) \in \mathbb{Z}_m \times \mathbb{Z}_n \}$

$E := \{ (x,y) \in \mathbb{Z}_m \times \mathbb{Z}_n \}$

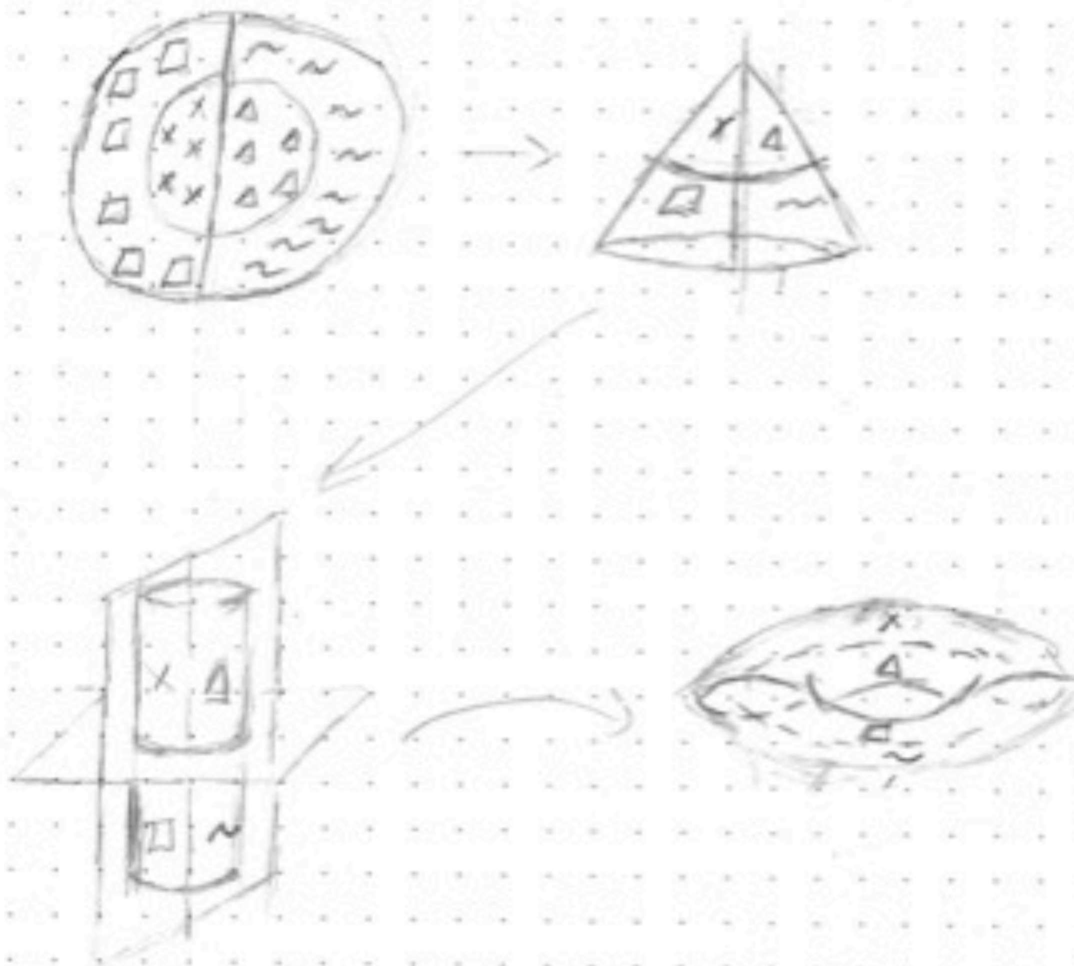
$K = \min_{z \in [x]_m \cap [y]_n} |Z|$

$K_m^n := [x]_m \cap [y]_n$

Useful to embedding?

- To crossing number problem!

see pg. 4.



Data Analytics - Classification Method

Four classes in bullseye like pattern mapped to torus.

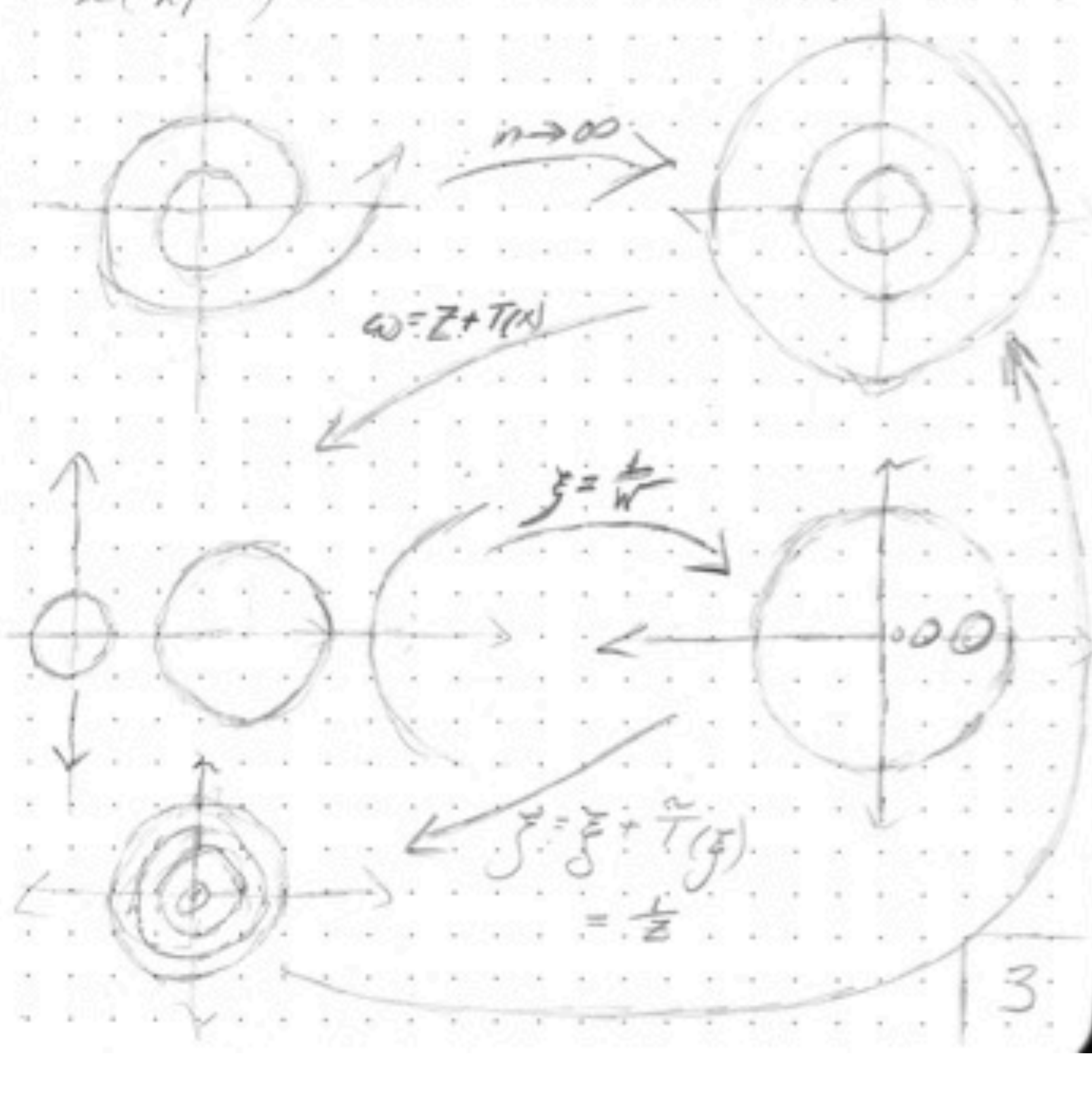
Let $f_n(x) = \underbrace{f \circ \cdots \circ f(x)}_{n}$ and $f_n \to [\;]$

as $n \to \infty$.

Let $\tilde{\pi}_n(x) = f_n \circ \beta(x)$ s.t. $\tilde{\pi} \to \pi$ as $n \to \infty$.

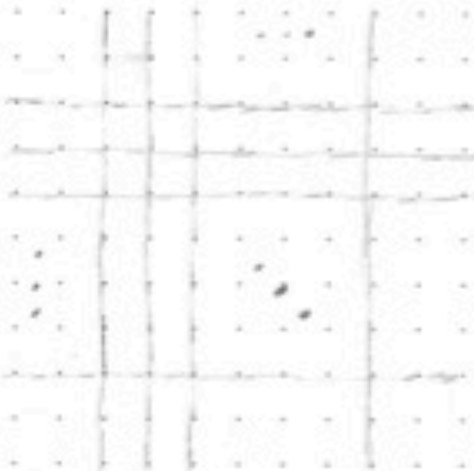
Observe the following maps:

$$z_n = (f_n \circ \beta(x)) e^{2\pi i (f_n \circ \beta(x))} \xrightarrow{n \to \infty} z = \pi(x) e^{2\pi i \tilde{\pi}(x)}$$



Crossing Number

$G(V, E)$



$v = ([x]_m, [y]_n)$

$\sim \{z \in [x]_m \cap [y]_n\}$

$\Gamma := \{([x]_m, [y]_n) \in \mathbb{Z}_m \times \mathbb{Z}_n\}$

$V(G) := \{v_i \in \Gamma\}$

$E(G) := \{(v_i, v_j) \in \Gamma \times \Gamma\}$

It appears "Möbius relations" on

$X : (v_a, v_b) \mapsto (v_\alpha, v_\beta)$

predict crossings.

In particular, given

$X_n = \{[(x, a), (1-x, b)], [(1-x, a), (x, b)]\}$

$= \{[v_1, v_2], [v_3, v_4]\}$

$= \{[E_1], [E_2]\}$

Example to follow...

Crossing Number

$G = K_6$

Notation:

$E_p \xrightarrow{x_n} E_q$ | "E_p crosses E_q"

$(v_1, v_4) \xrightarrow{x_1} (v_2, v_3)$

$(v_3, v_6) \xrightarrow{x_2} (v_4, v_5)$

$(v_2, v_5) \xrightarrow{x_3} (v_1, v_6)$

G on T^2

~ Reps. x_2

Next PG

$\{[(0,0),(1,1)],[(1,0),(0,1)]\} = X_1$

$\{[(0,1),(1,2)],[(1,1),(0,2)]\} = X_2$

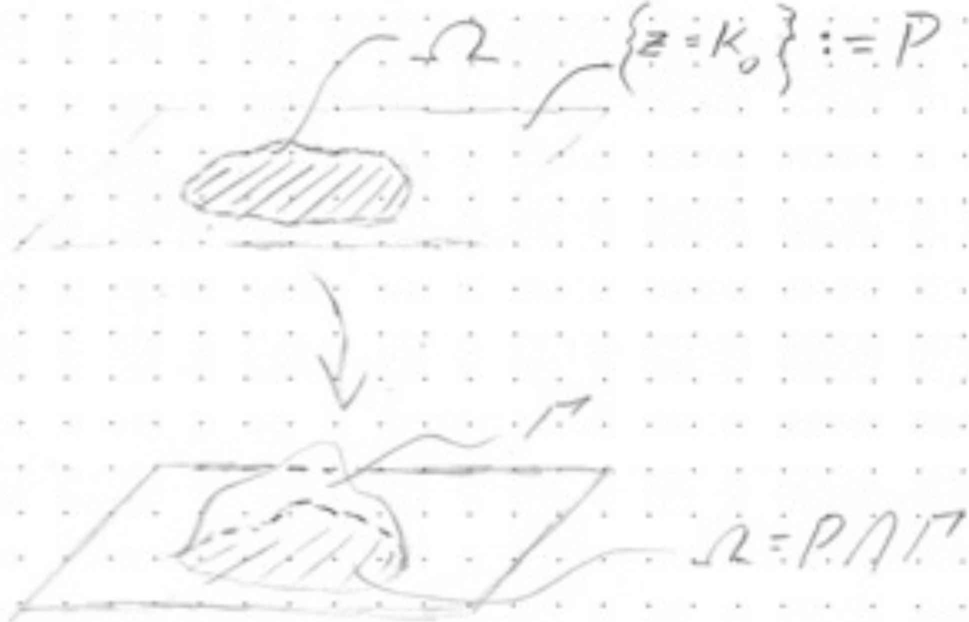
$\{[(1,0),(0,2)],[(0,0),(1,2)]\} = X_3$

Seems to support hypothesis about "möbius relation."

- Application of Cohomology to find topology?
- Projective Planes?

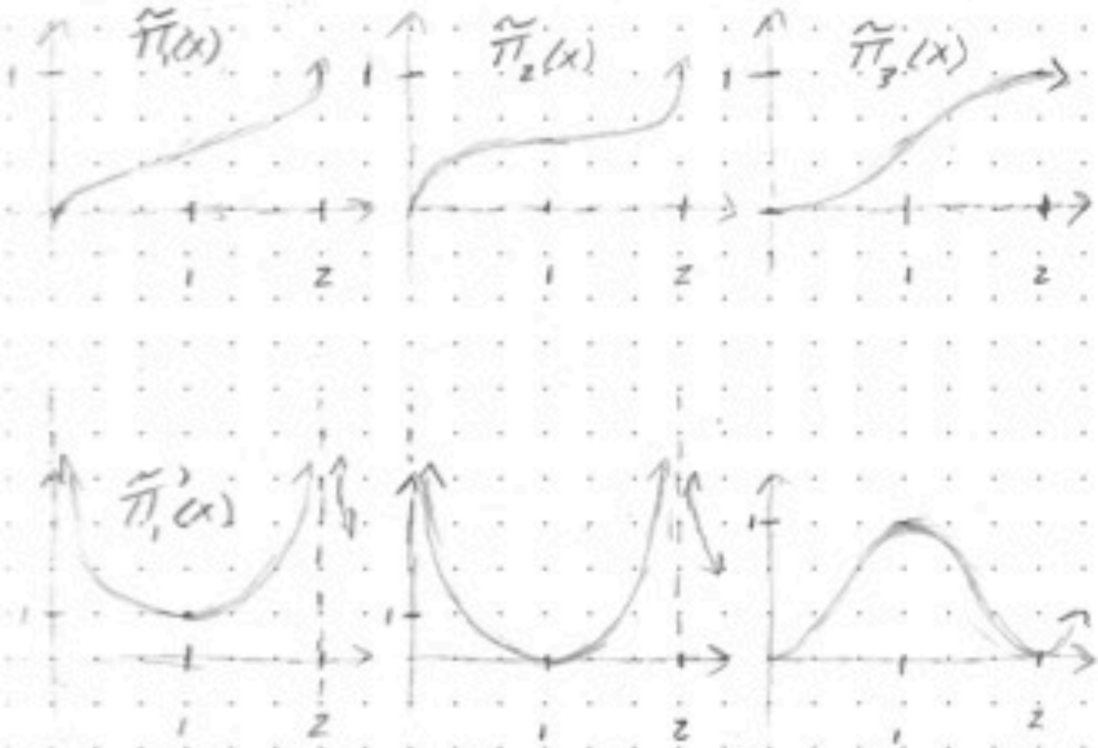
Consider a corked sample jar sitting inside some finite volume. Inside the jar is some medium which will instantly turn into a gas when the jar is uncorked. Let there also be a speaker inside the jar which begins playing a tone the moment the jar is uncorked. Clearly the diffusion equation is, in general, not time-reversible; but, assuming the gas is diffusing into a volume, what of the wave equation corresponding to the tone emitted by the speaker? Is it time-reversible? And what information can we recover via the corresponding inverse problem, given data at some time $T \neq 0$?

Coast Line Paradox



- Using something like gradient decent it may be posible to recover leng of $\partial\Omega$.
- Application of Turring Patterns may be useful here.

Candidate $\tilde{\pi}(x)$ + $\tilde{\pi}'(x)$



$\tilde{\pi}_1'(x) \sim |\sec(kx)|$

$\tilde{\pi}_2'(x) \sim |\sec(kx)| - 1$

$\tilde{\pi}_3'(x) \sim \frac{1}{2}(\sin(kx) + 1)$

- Seeking for continuous approximation of Prime Counting function

Consider a trip from home to the hospital, there might be 3 reasons for this

1) a birth (positive)
2) routine checkup (neutral)
3) a death (negative).

In all three cases you will, presumably, drive different. So, by observing the deviations in your decision making it is reasonable to assume one can measure your emotional state.

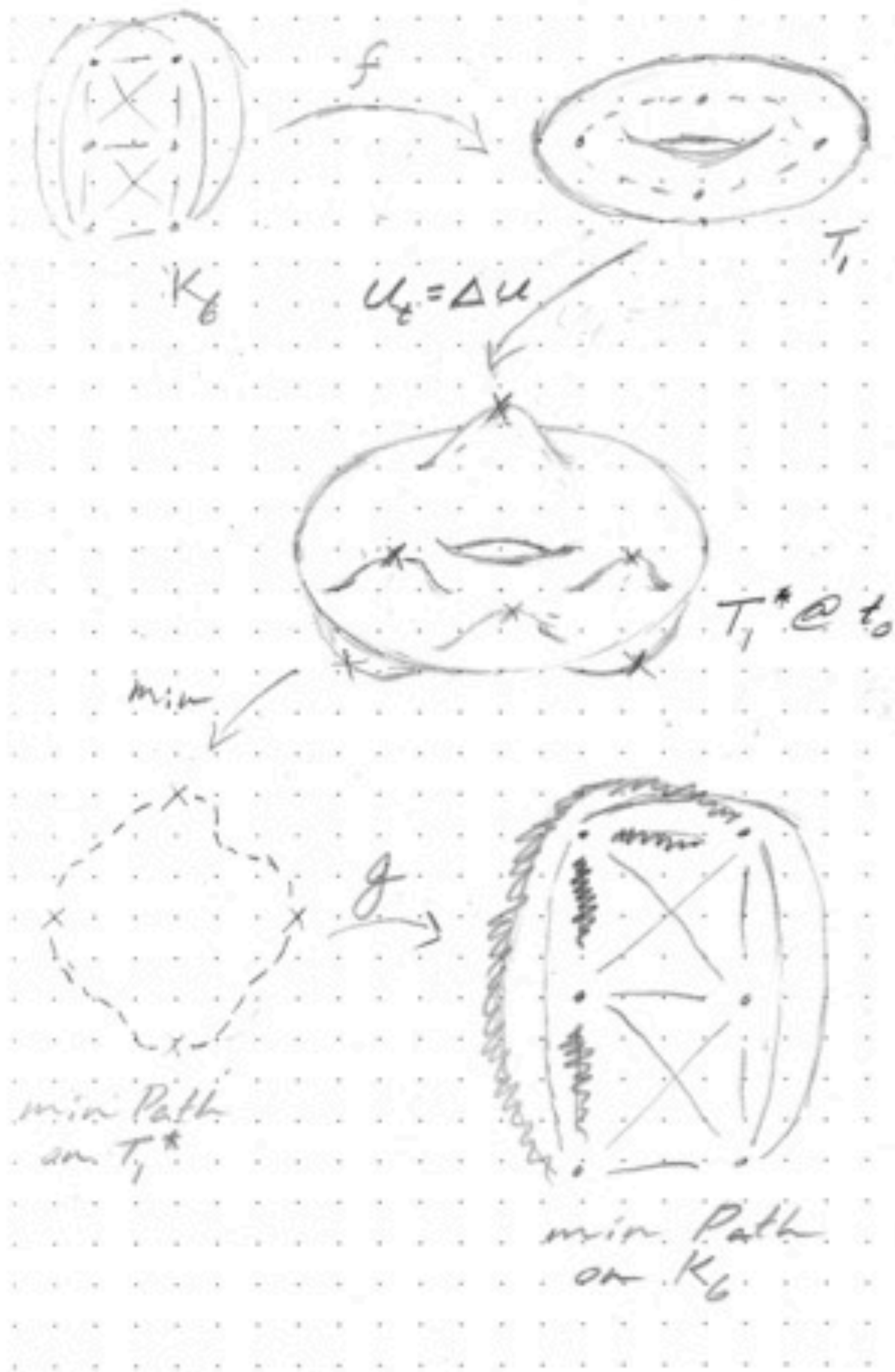
- Extension of undergrad thesis
- Observation of risk may be more fruitful than general decision making.

Traveling Salesman Problem

1) Map the graph $\Gamma(E,V)$ onto an n-genus torus, T_n.
2) Solve the Heat Eq. on T_n using the image of the vertex set to inform the I.V.P.
3) Apply minimization method to contours, between images of vertex pairs, on the deformed torus, T_n^*, @ t_0
4) Map result back to Γ.

- Image of method on next pg

Traveling Salesman Problem



Imagine a 2-player differential game where the two players represent ortogonal components of a vector in $\mathbb{R}^2$. What must the payoffs + rules be for the "optimal game" to maximize the area + minimize the length of path "traced by the game?"

What modifications are necessary to accomodate higher dimension geometries?

- Clearly in the case of higher geometries we would replace length with surface area + area with volume; but what else changes?

Could the impass between Quantum and Relativity be the result of a physical construct similar to Gödel's Theorem?

My approach to the TSP breaks down to –

1). Embedding a graph Γ onto some n-genus torus. T_n

i) I suspect the solution to the embedding problem will be derived from the solution to the crossing number problem.

– Justification comes from imagining isomorphic graphs in a plane as different projections of a single graph, embedded on a torus, onto the plane.

2). Development of deformed torus T_n^*

i) Heat Equation seems like the natural machinery to use here. However, other tools may exist and be better.

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3) Path minimization on T_n^*

i) In the case of directed graphs + graphs which are not complete it may be best to make use of Finsler Geometry or some other quasimetric space.

4) Mapping sol. from T_n^* to Γ.

Thought -

It may be possible to reframe embedding as an "orchard problem"

- Imagine you're standing on a vertex, and all of the remaining verticies are trees. What geometry is required to see all of the trees?
- Only for K_n