Translation is fun

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December 10, 2022

In this article, we discuss some applications of pattern recognition in graph theory.

Example (Match the phrases)

Match the phrases in Vietnamese on the left of the table below, with their translations into English on the right of the table.

1	băng	A	bouquet (a bunch of flowers)
2	bó	B	chalk
3	bó hoa	C	circle
4	cánh hoa	D	cluster
5	đá	E	detour
6	đá lửa	F	fire
7	đá phấn	G	flint (a stone used to make sparks)
8	đường	H	flower
9	đường vòng	I	ice
10	hoa	J	iceberg
11	lửa	K	mountain
12	mở	L	petal
13	mở đường	M	pollen
14	mở mắt	N	powder
15	núi	O	road
16	núi băng	P	rock
17	núi lửa	Q	tear (as in teardrop)
18	nước đá	R	to make aware
19	nước mắt	S	to open
20	phấn	T	to pave the way
21	phấn hoa	U	volcano
22	vòng	V	wreath
23	vòng hoa		

Solution. We use a graph theory approach from the point of view of an English speaker to solve the problem.

First, we look at the Vietnamese phrases. They are single- and double-word phrases. We connect the phrases in a graph so that each pair of phrases consists of a single-word phrases and a double-word phrase, the double-word phrase basically contains the single-word phrase. See the diagram below.

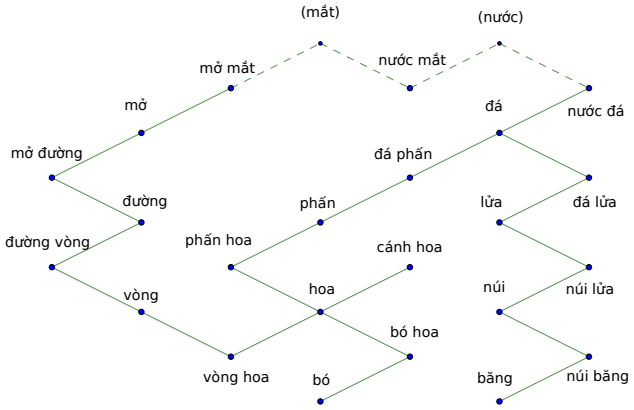

Figure 1: Graph of Vietnamese phrases

The graph of Vietnamese phrases, we presume, represents connections in *shared meaning* between phrases. Thus, we connect the English phrases in the same way, each phrase with another so that one has a meaning that shall be contained by the meaning of the other. The result is the diagram below.

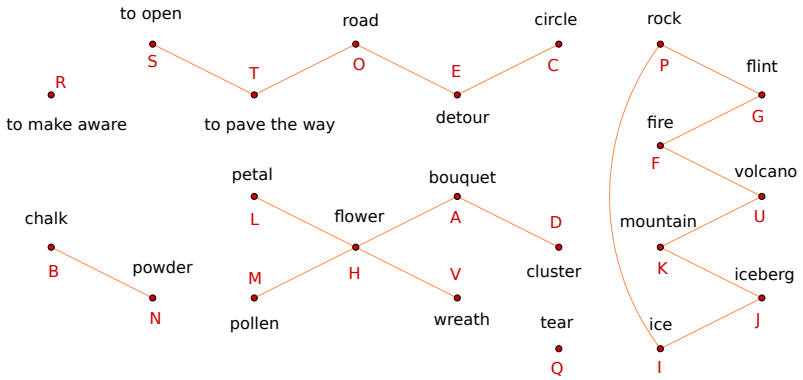

Figure 2: Graph of English phrases

Comparing the graph, only the $5-$*vertex* subgraphs *(phấn hoa, vòng hoa, cánh hoa, bó hoa, hoa)* and *(bouquet, petal, pollen, wreath, flower),* are *topologically* equivalent, thus *hoa=flower*. Note that the relation between *pollen* and *powder*, implies that *powder* is *phấn*. The rest of the vertices then can be paired up *petal - cánh hoa, bouquet - bó hoa, pollen - phấn hoa, wreath - vòng hoa.* Therefor *bó - cluster*, and *chalk - đá phấn.*

Similarly the paths *(băng - núi băng - núi - núi lửa - lửa - đá lửa - đá - nước đá) (ice - iceberg - mountain - volcano - fire - flint - rock)* are very much alike, in addtion, the relation of *đá - đá phấn* is similar to *rock - chalk,* which make both *nước đá* and *băng* to have the meaning of *ice*. Similarly the paths *(vòng - đường vòng - đường - mở đường - mở) (to open - to pave the way - road - detour - circle)* are very much alike.

Following the reasoning, we can fill the table as shown below.

#	Vietnamese	Literal meaning	Answer	English
1	băng	ice	I	ice
2	bó	cluster	D	cluster
3	bó hoa	flower cluster	A	bouquet
4	cánh hoa	flower wing	L	petal
5	đá	rock	P	rock
6	đá lửa	fire rock	G	flint
7	đá phấn	powder rock	B	chalk
8	đường	road	O	road
9	đường vòng	circle road	E	detour
10	hoa	flower	H	flower
11	lửa	fire	F	fire
12	mở	to open	S	to open
13	mở đường	to open a road	T	to pave a way
14	mở mắt	to open eyes	R	to make aware
15	núi	mountain	K	mountain
16	núi băng	ice mountain	J	iceberg
17	núi lửa	fire mountain	U	volcano
18	nước đá	rock water	I	ice
19	nước mắt	eye water	Q	tear
20	phấn	powder	N	powder
21	phấn hoa	flower powder	M	pollen
22	vòng	circle	C	circle
23	vòng hoa	flower circle	V	wreath

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