INSTITUTO POLITÉCNICO NACIONAL
ESCUELA SUPERIOR DE FÍSICA Y MATEMÁTICAS
Encuentro Amistoso entre el IPN y la Universidad de Yonsei 2023

Questions

1- How many solutions in Z/2Z does the equation x_1+x_2+x_3(x_4+x_5)+x_2x_6=0 have?

2- A simple circuit C of an undirected graph $G=(V,E)$ is a sequence $(v_1, \ldots, v_n)$ with $n>3$ such that for all $1\leq i < n$, v_{i+1} is a neighbor of v_{i}, $v_n = v_1$ and no other term of the sequence appears more than once. We say that an edge $e\in E$ is in C if $e=(v_{i},v_{i+1})$ for some $1\leq i < n$.

Given a collection of simple circuits $C_1,\ldots,C_m$, we say they form an $\textbf{independent set}$ if for every $1\leq i \leq m$ there is at least one edge e_i in C_i such that e_i is not in C_j if $j\neq i$.

Consider the following graph G, and determine the maximum number of independent simple circuits in it. That is, find $$M=\max\limits_{S \in \Sigma} |S|$$ where Σ is the set of all independent sets of G.

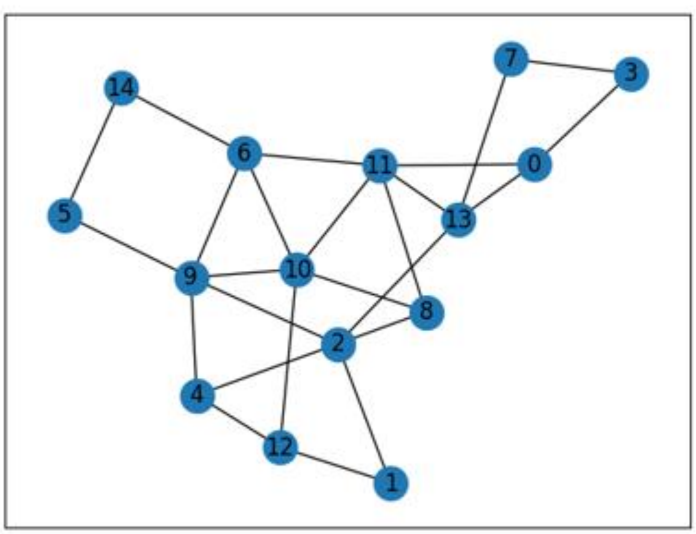
Graph illustration and adjacency matrix below.

A simple circuit C of an undirected graph G=(V, E) is a sequence (v_1, ..., v_n) with n>3 such that for all 1<= i < n, v_{i+1} is a neighbor of v_{i}, v_n = v_1 and no other term of the sequence appears more than once. We say that an edge e in E is in C if e=(v_{i}, v_{i+1}) for some 1<= i < n.

Given a collection of simple circuits C_1,...,C_m, we say they form an \textbf{independent set} if for every 1<= i <= m there is at least one edge e_i in C_i such that e_i is not in C_j if j != i.

Consider the following graph G, and determine the maximum number of independent simple circuits in it. That is, find M=max(limits_{S in Sigma} |S|) where Sigma is the set of all independent sets of G.

Graph illustration and adjacency matrix below.



INSTITUTO POLITÉCNICO NACIONAL
ESCUELA SUPERIOR DE FÍSICA Y MATEMÁTICAS
Encuentro Amistoso entre el IPN y la Universidad de Yonsei 2023

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
2	0	1	0	0	1	0	0	0	1	1	0	0	0	1	0
3	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0
5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
6	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1
7	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
8	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0
9	0	0	1	0	1	1	1	0	0	0	1	0	0	0	0
10	0	0	0	0	0	0	1	0	1	1	0	1	1	0	0
11	1	0	0	0	0	0	1	0	1	0	1	0	0	1	0
12	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0
13	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0
14	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

3- A medical test has sensibility 80% and specificity 98%. If the prevalence of the disease is 85%, what is the probability of being sick if the test is negative.