

# Satisfiability Threshold of the Random Regular $(s,c,k)$ -SAT Problem

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# Problems & Ideas

- A method to find the threshold of random  $(s,c,k)$ -SAT problem.
  - **Problem:** Given a random regular  $(s,c,k)$ -CNF formula  $F$  with  $n$  variables and  $m$  clauses. Our goal is to find the threshold of random  $(s,c,k)$ -SAT problem, and find the influence of positive and negative occurrences of variable on satisfiable problems.
  - **Current Problem:** The random regular  $(s,c,k)$ -SAT problem is a kind of  $(k,s)$ -SAT problem proposed for the first time in our paper, which limits the occurrences of positive and negative variables for each variable. The research content of this kind of problem still has in-depth development.
- Ideas: Introduce a special random experiment and use the first moment method to analyze the satisfiability threshold of the SAT problem.
  - Calculate the number of satisfying solutions of any random regular  $(s,c,k)$ -CNF formula.
  - Let the expected number of satisfying solutions of CNF formula be zero, so as to get the threshold of random regular  $(s,c,k)$ -SAT problem.

# Main Contributions

- Contributions

- We give the satisfiable threshold of random regular  $(s,c,k)$ -SAT problem;
- We give the satisfiable threshold of random regular  $(s,r,k)$ -SAT problem;
- Several simulation experiments are given to verify the correctness of the theoretical results.

Table1: The value of Satisfiability probability, when  $c = 0.5$ ,  $k = 3$  and  $s > 8$ .

	s=8	s=10	s=11	s=12	s=13	s=14	s=15	s=18
n=90	1	0.8	0.25	0	0	0	0	0
n=126	1	0.71	0.20	0	0	0	0	0
n=144	1	0.60	0.15	0	0	0	0	0

Table2: The value of Satisfiability probability, when  $c = 0.5$ ,  $k = 4$  and  $s > 32$ .

	s=32	s=36	s=44	s=46	s=48	s=50	s=52	s=54
n=90	1	0.17	0	0	0	0	0	0
n=126	1	0.08	0	0	0	0	0	0
n=144	1	0.01	0	0	0	0	0	0