EXTREMEgen

Breaking Weighted Model Counters

AUTHORS

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1. Weighted Model Counting

CNF: $(x \lor \neg y) \land (\neg x \lor y)$
WCNF:
- w(x)=0.6, w(¬x) = 0.4
- w(y)=0.3, w(¬y) = 0.7

x	y	F	Probability
0	0	1	$0.4 \cdot 0.7 = 0.28$
0	1	0	0
1	0	0	0
1	1	1	$0.6 \cdot 0.3 = 0.18$
		Total	$0.28 + 0.18 = 0.46$

Fig. 1: Example Calculation Weighted Model Count

2. Probabilistic Inference

Example Inference:
The alarm is on and the bus is not late.
What is the probability you are on time?

Fig. 2: Example Bayesian Network
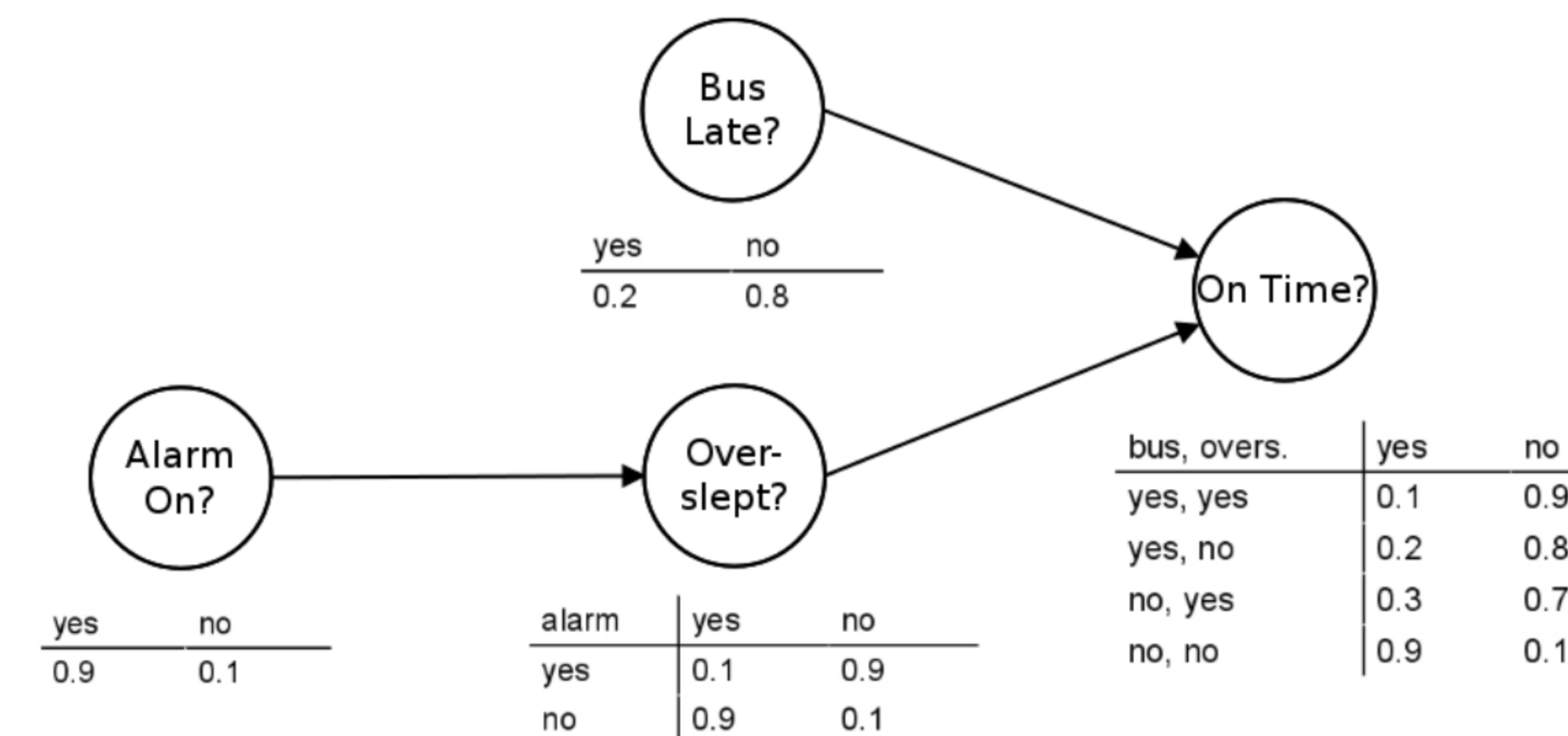
Risk Assessment

Medical Diagnosis

3. Breaking Solvers With Fuzzing
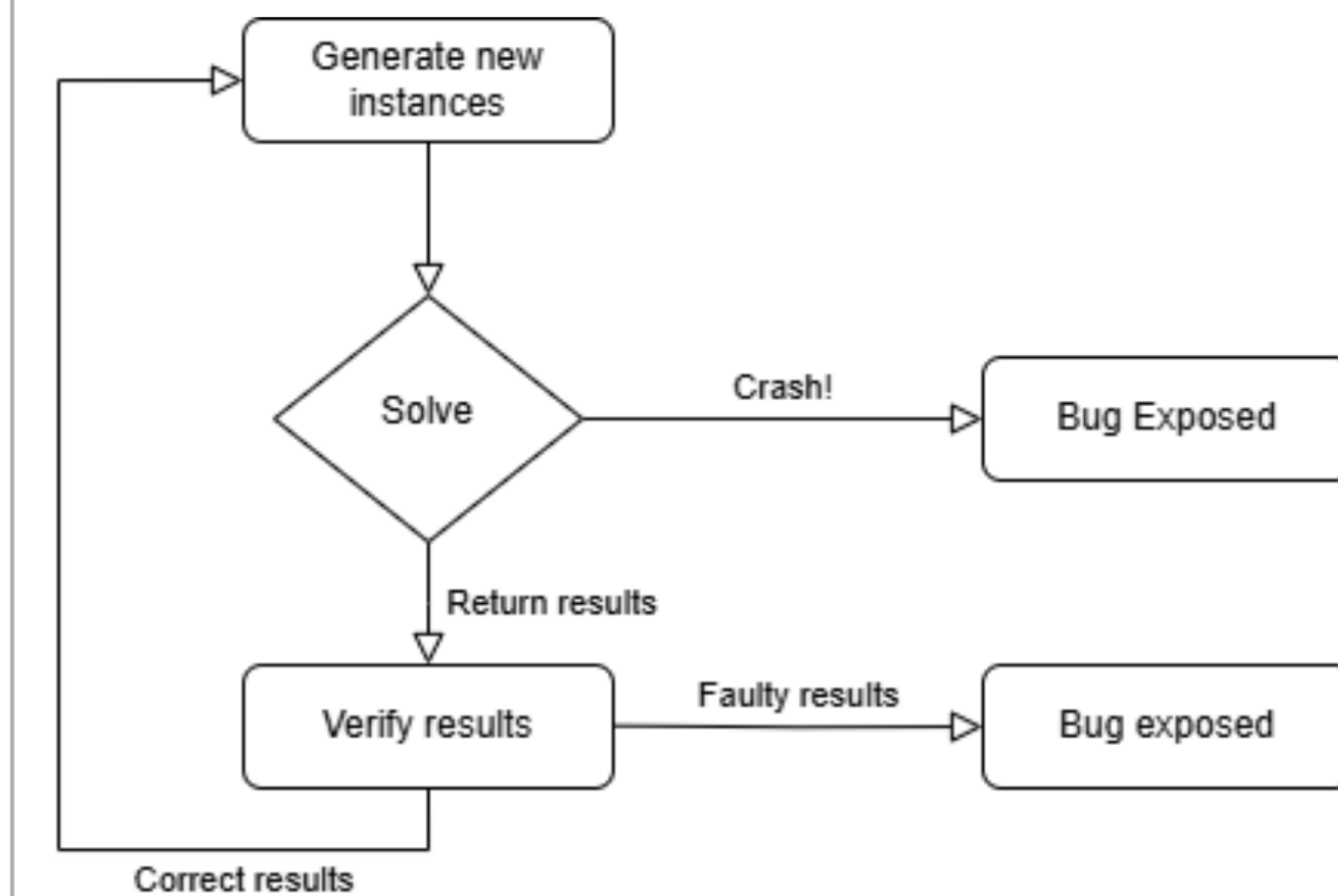
Fig. 3: Fuzzing Procedure using SharpVelvet [1]

3. Generating Breaking Instances

3 topologies:
- DQMR[2][3]
- GRID[3]
- TREE

Extreme Weights:
- floating points
- scientific notation
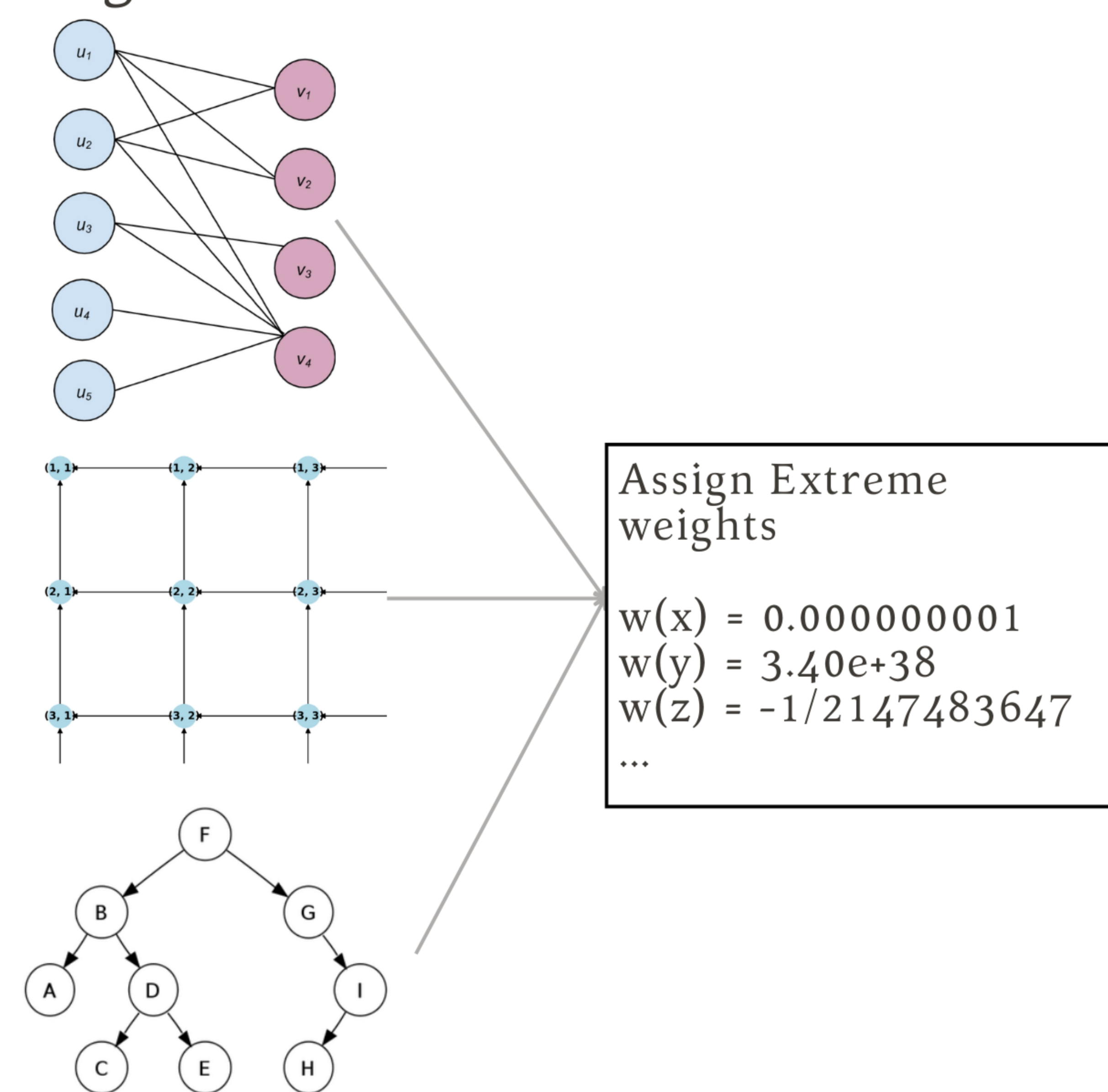- fractions

Data format IEEE 754

Assign Extreme weights

w(x) = 0.000000001
w(y) = 3.40e+38
w(z) = -1/2147483647
...

Fig. 4: EXTREMEgen generation procedure

4. Results

Algorithm	Timeout	Wsat	Wsum
gpmc	101	174	174
ganak-conf-1	0	0	174
ganak-conf-2	0	0	174
SharpSAT-TD-weighted	0	0	174
SharpSATTD-CH-weighted	0	0	174

Table 1: Amount of bug exposing instances found.

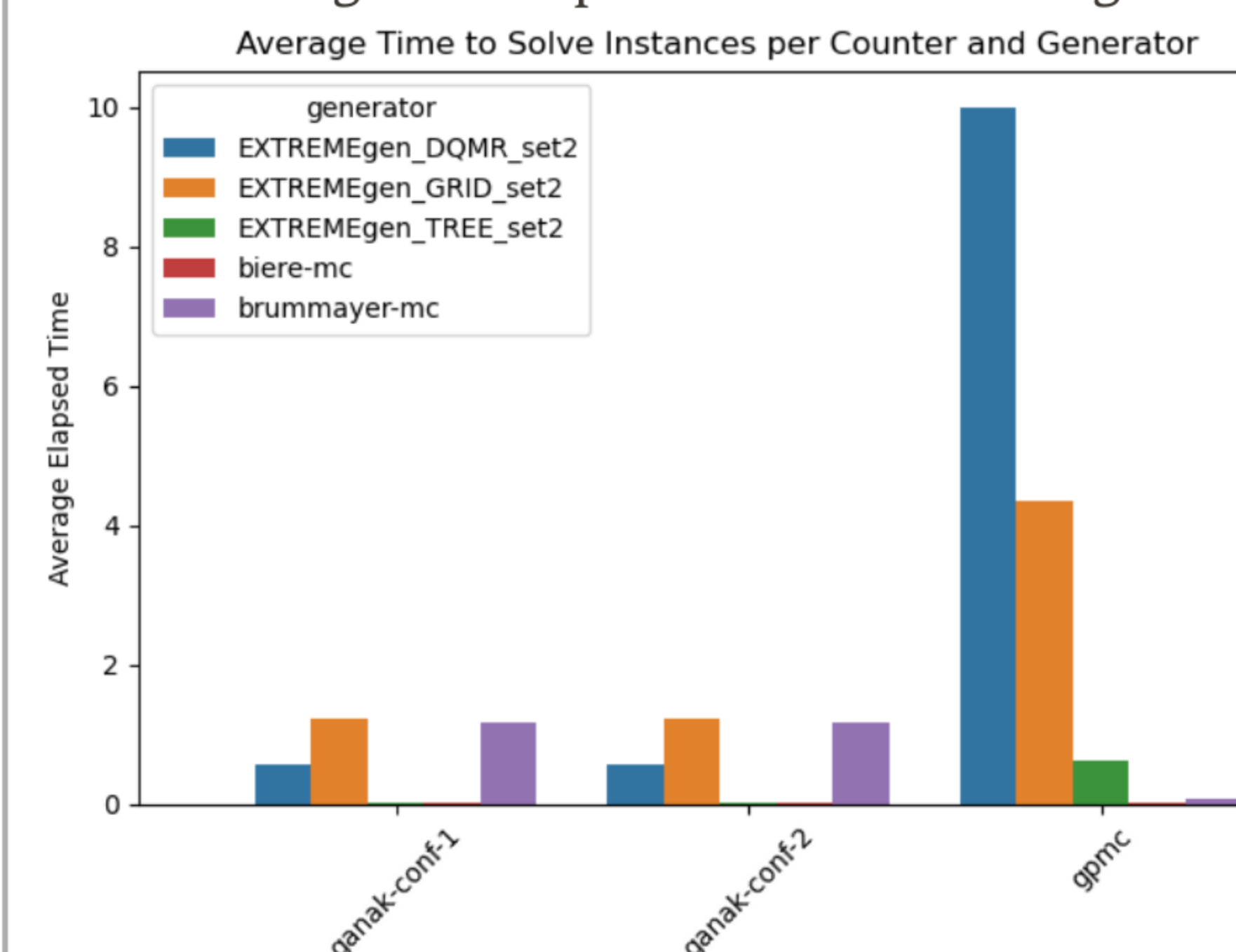EXTREMEgen compared to baseline generators[4]
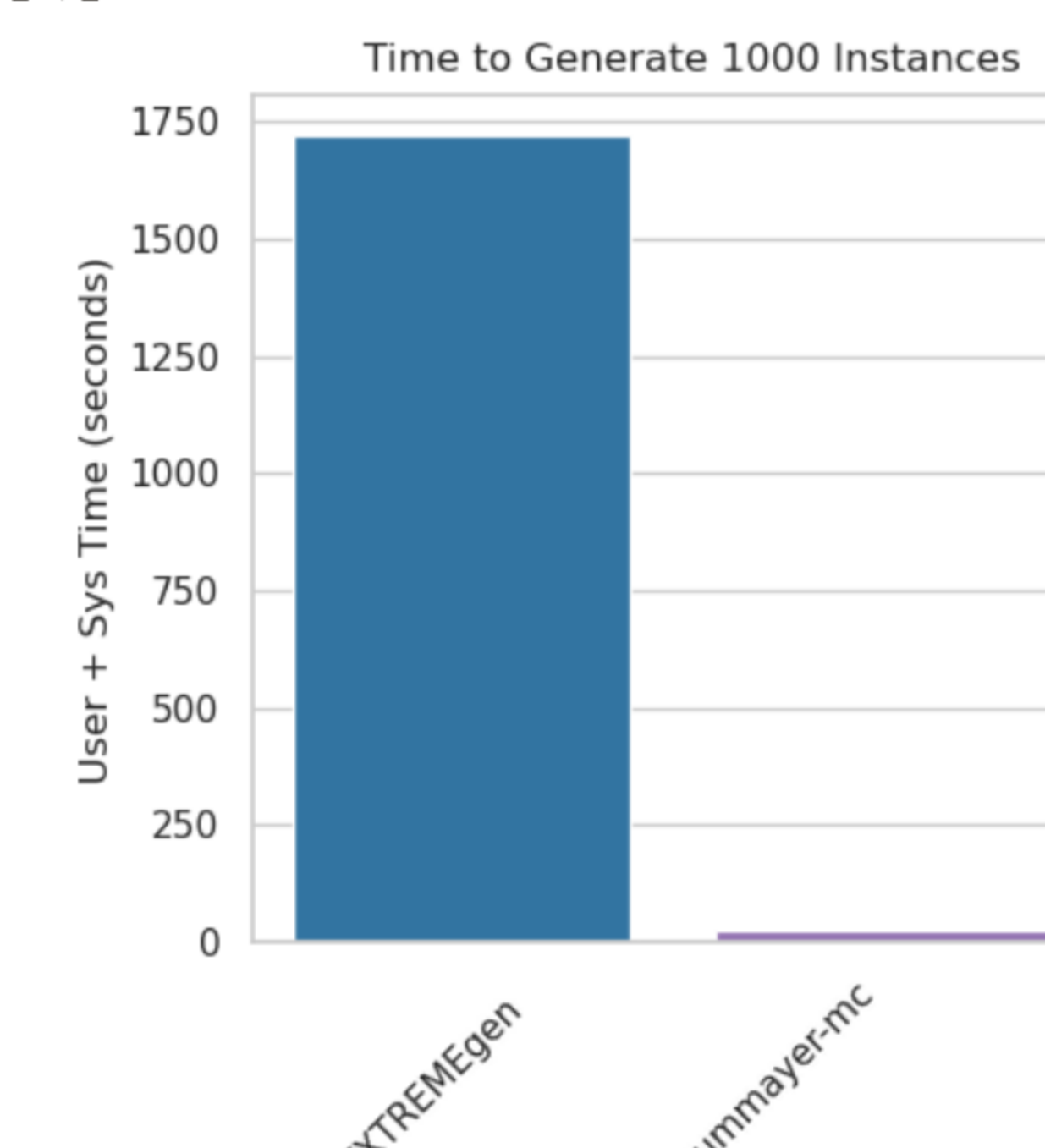

Fig. 5: Average time taken to solve instances.

Fig. 6: Time taken to generate instances

5. Conclusion

RQ1.
Did we expose bugs?

✅

RQ2.
Are instances solved fast?

✅

RQ3.
Is generation fast enough?

❌

6. Sources

[1] Soos, Latour. (2024)
[2] Shwe et al,. (1991)
[3] Sang et al,. (2005)
[4] Brummayer et al,. (2010)