The modified construction of the second order memory-based LT code

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2018.11.17

2018년 한국통신학회 추계종합학술발표회

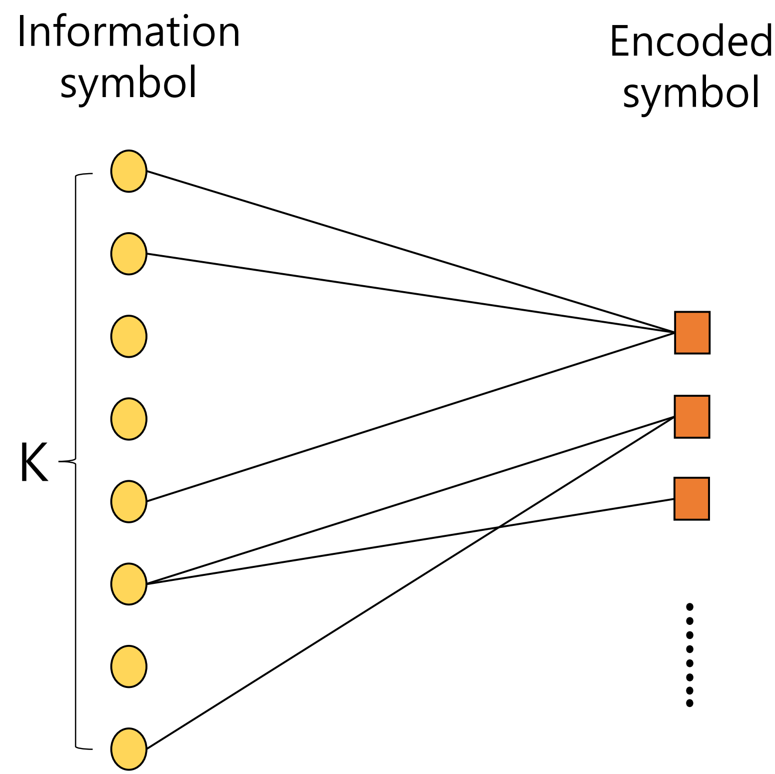
LT code - Encoding

- LT code is the rateless code.
- $(K, \Omega(x))$ LT code

  $\boldsymbol{K}$: the number of information symbol

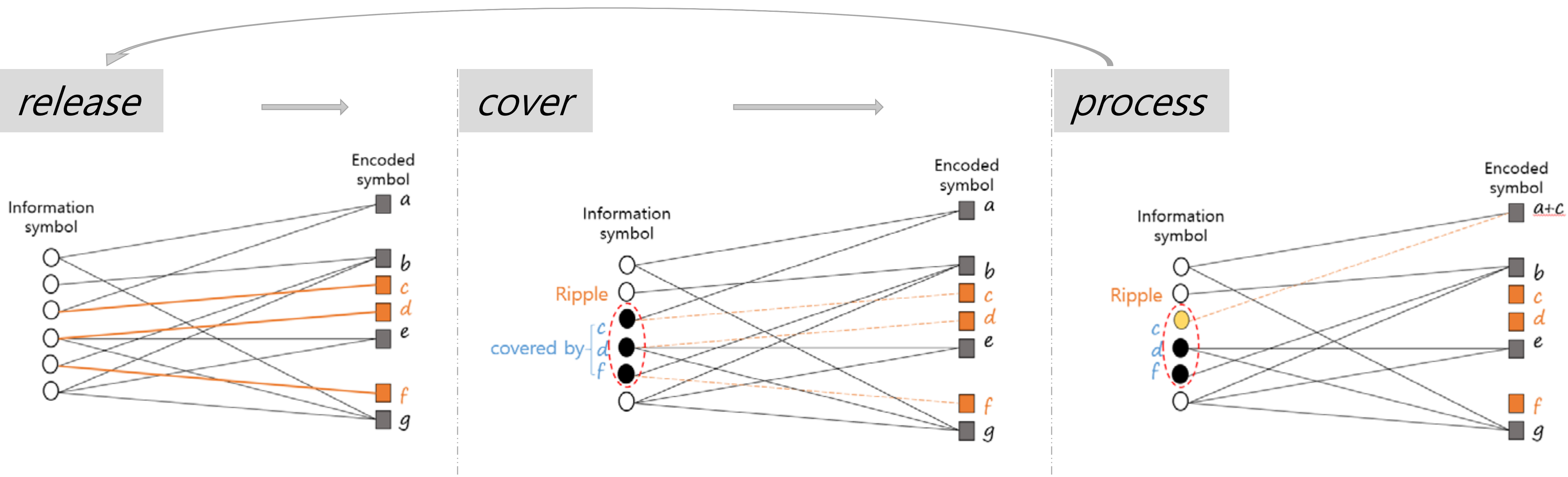
  $\boldsymbol{\Omega(x)}$: the degree distribution of encoded symbol

* *__all encoded symbols__* select information symbols ***randomly***.



LT code - Decoding

Assume binary erasure channel (BEC)



* **generate the** **new encoded symbol with $d_r = 1$** **after each iteration**

- success rate: $\frac{the\ number\ of\ success}{the\ number\ of\ test}$
- overhead: $(\gamma = \frac{N-K}{K})$

i^{th}-order Memory-based LT code

In order to generate the new encoded symbol with $d_r = 1$ after each iteration, MBLT code utilizes the information of the previous encoded symbol to release more encoded symbols than LT code in the decoding process.

Encoding:

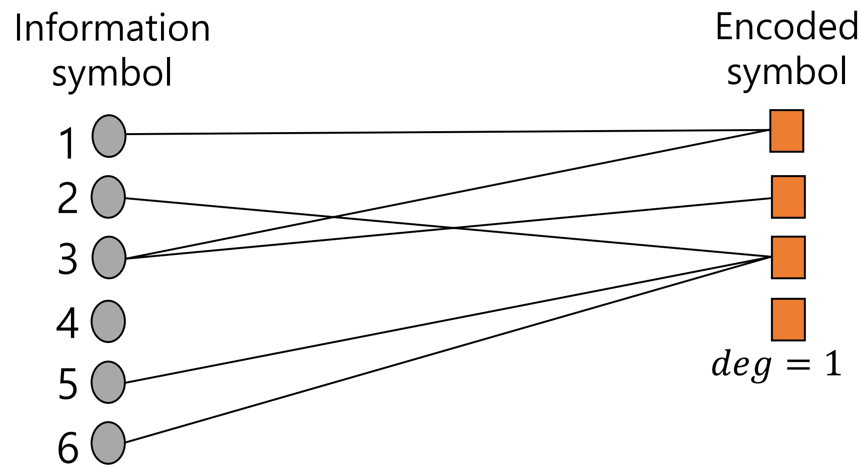
- encoded symbol with degree $\mathrm{d_r} \leq \mathrm{i}$
  select information symbols based on some rules ;
- encoded symbol with degree $d_r > i$
  same as the LT code.

Decoding: same as the LT code

1^{st}-order MBLT code [1]

- Rule of the encoded symbol with $d_r = 1$:

  pick one information symbol with the **highest instantaneous degree** without replacement and put in the set S_1.



No. symbol / i-th encoding process	1	2	3	4	5	6
⋮	⋮					
3	1	1	2	0	1	1
4						

* <u>instantaneous degree</u> is the degree of the information symbol at the current encoding process.

[1]. K. Hayajneh, S. Yousefi, and M. Valipour, "Improved finite-length Luby-Transform codes in the binary erasure channel," IET Communications, vol. 9, no. 8, pp. 1122–1130, 2015.

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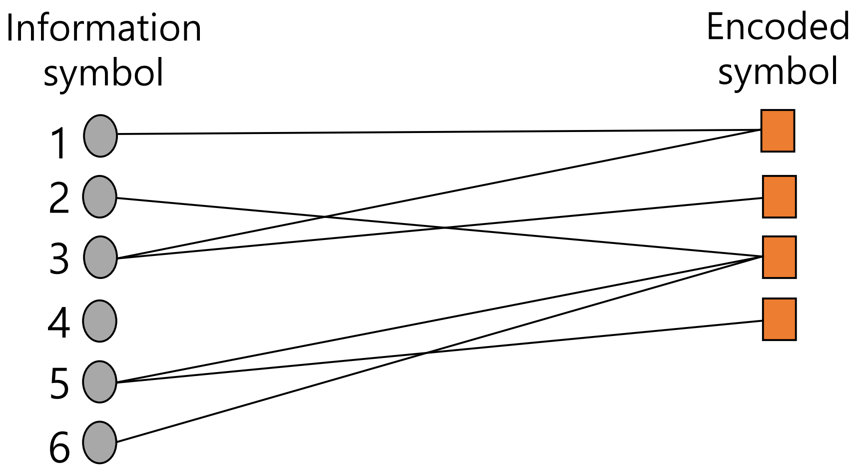

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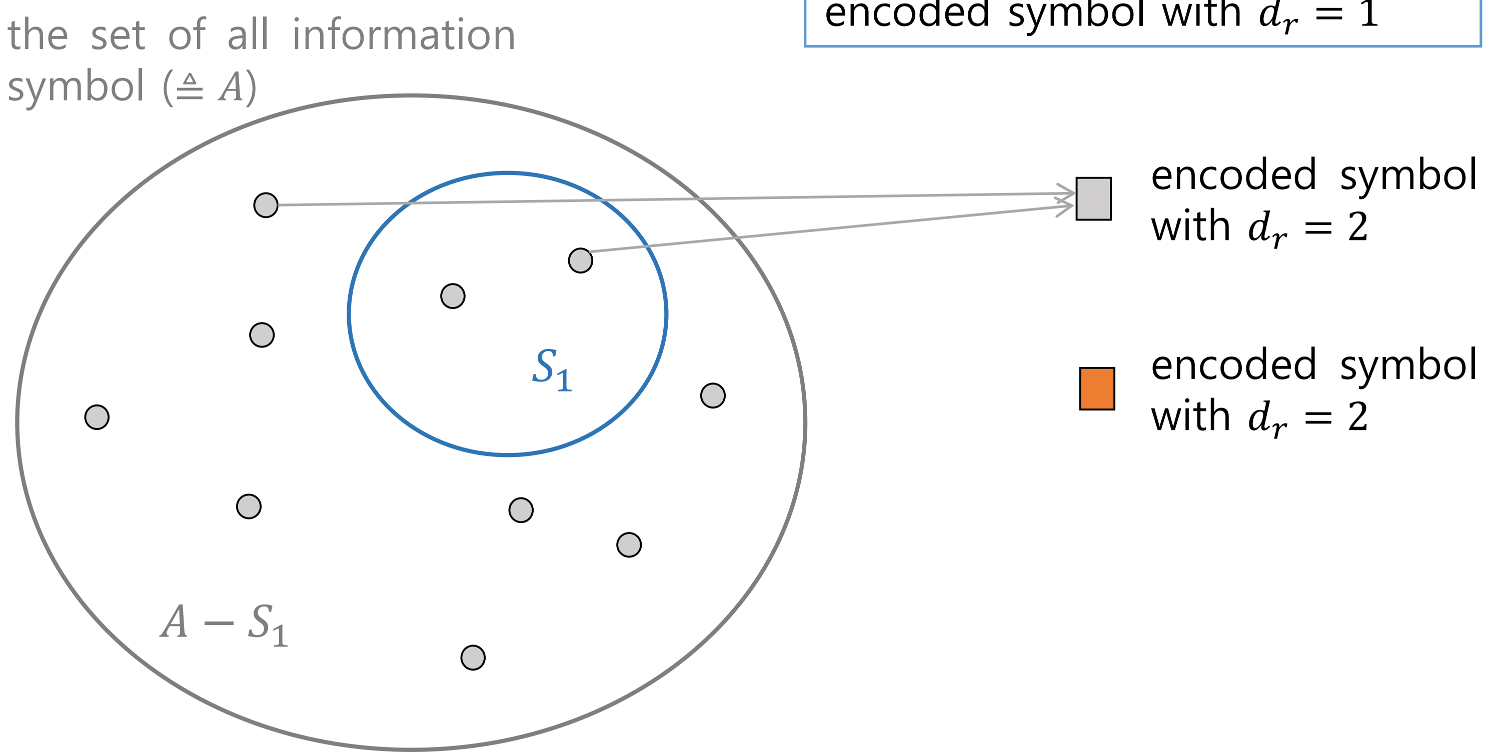
2^{nd}-order MBLT code [2]

$\boldsymbol{S_1}$: the set of information symbol that is selected by the encoded symbol with $d_r = 1$



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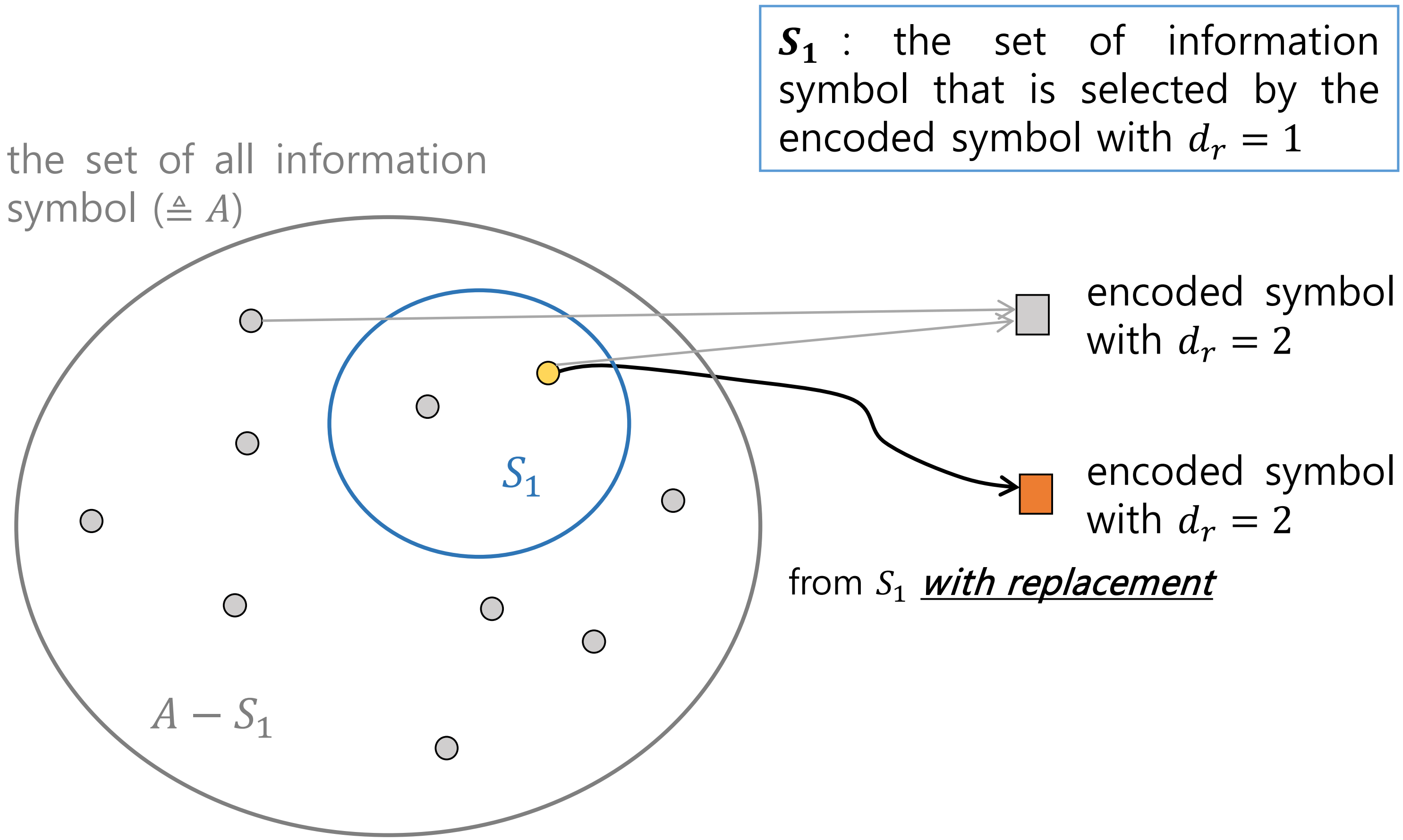

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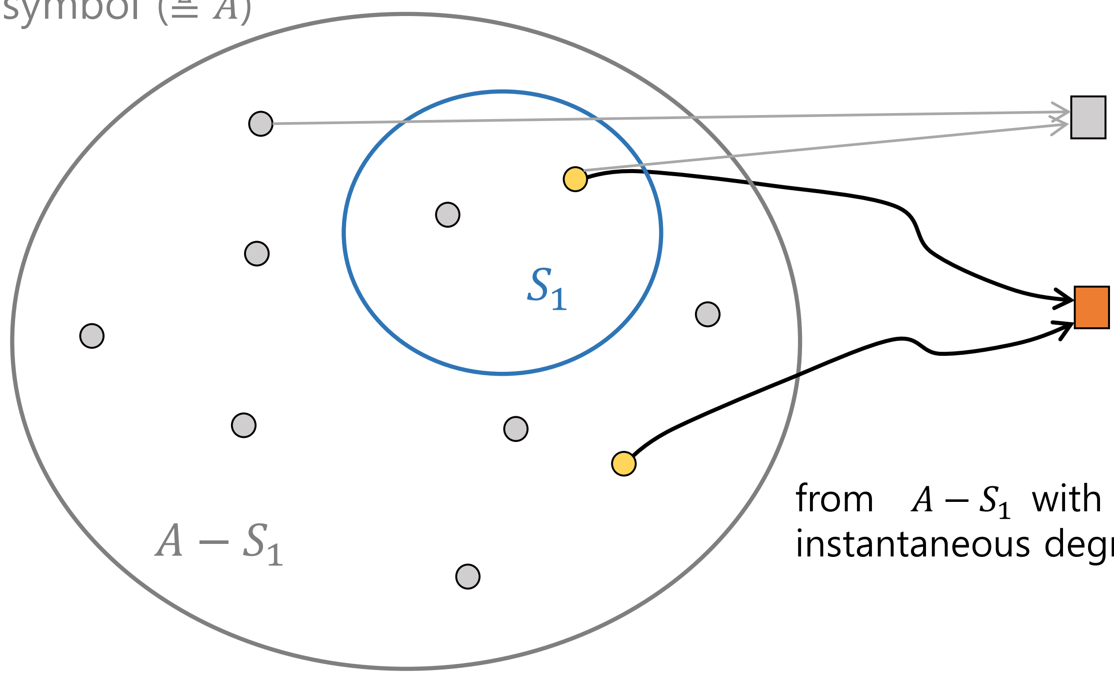
the set of all information symbol ($\triangleq A$)



encoded symbol with $d_r = 2$

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from $A - S_1$ with the highest instantaneous degree

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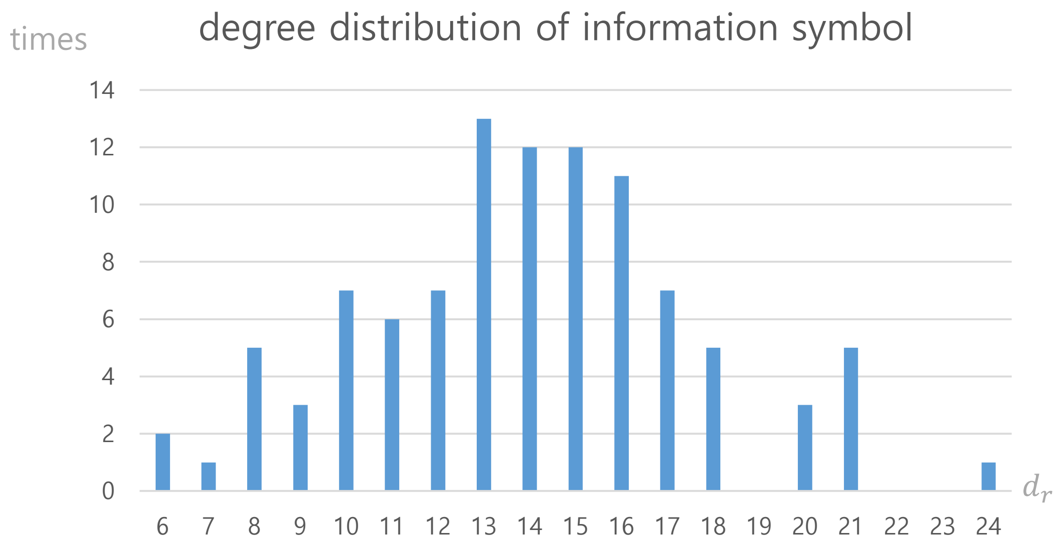
Motivation

In fact, $p(d_1) \ll p(d_2)$ (i.e. $p(d_1) = 0.04, p(d_2) = 0.45$).

The degree distribution of the information symbol of the 2^{nd}-order MBLT code is ***irregular***.



The simulation result of [3] shows that :

the decoding performance of whose degree distribution of information symbol is regular is better than the original LT code.

[3] I. Hussain, M. Xiao, and L. K. Rasmussen, "Error floor analysisof LT codes over the additive white Gaussian noise channel," 2011 IEEE Globecom Workshops (GC Wkshps), pp. 1–5, IEEE, 2011.

Modified 2^{nd}-order MBLT code

$\boldsymbol{S_1}$: the set of information symbol that is selected by the encoded symbol with $d_r = 1$;

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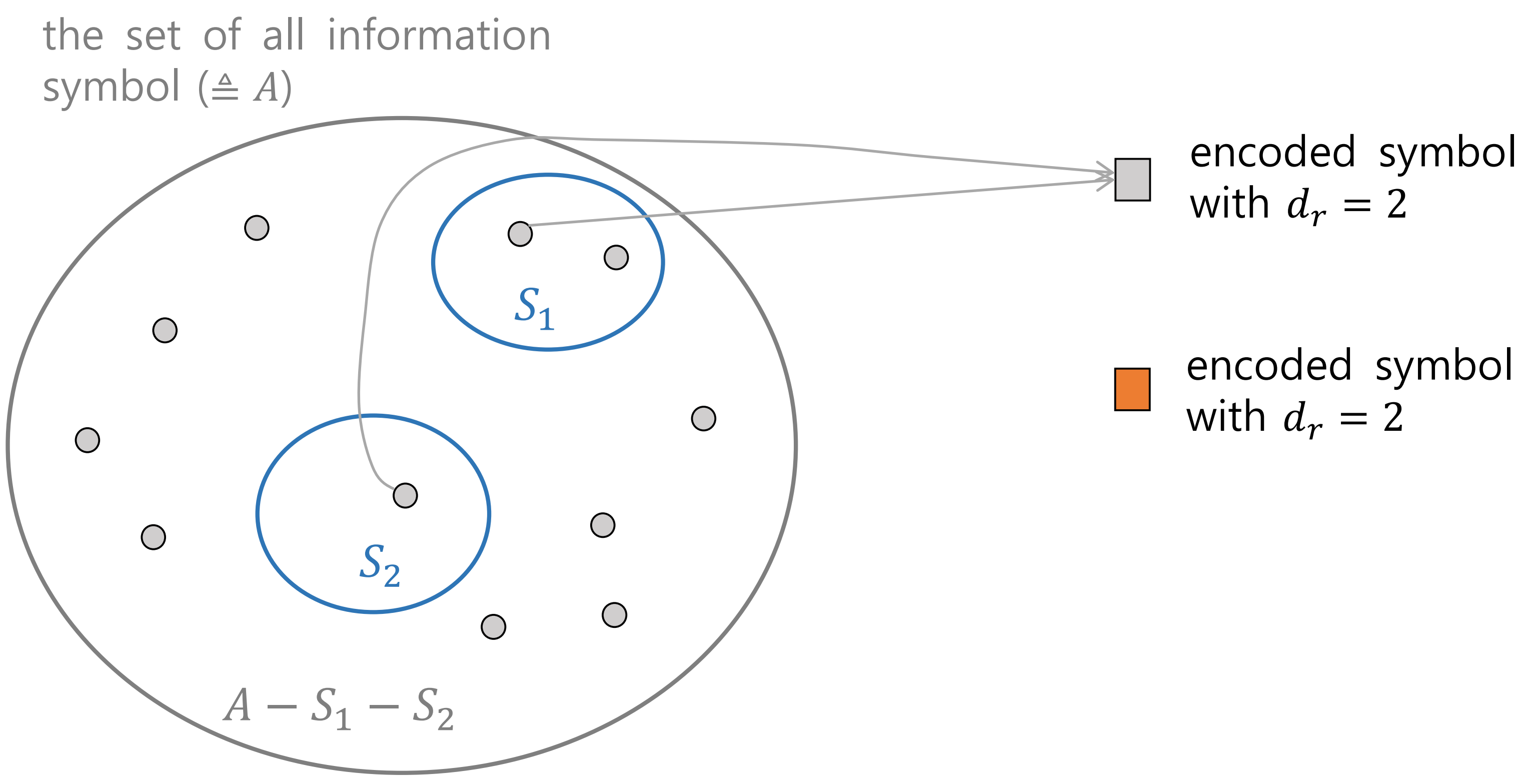

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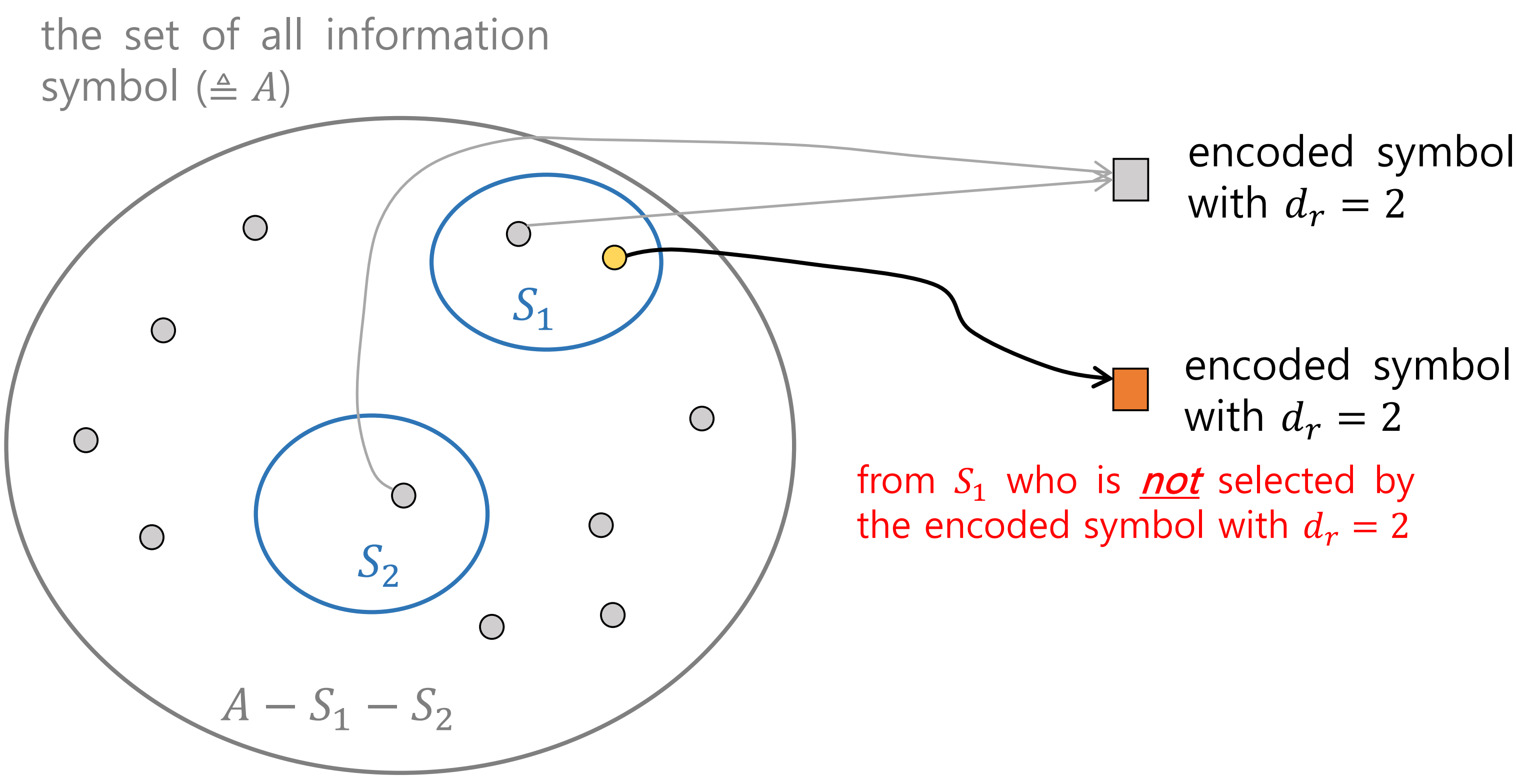

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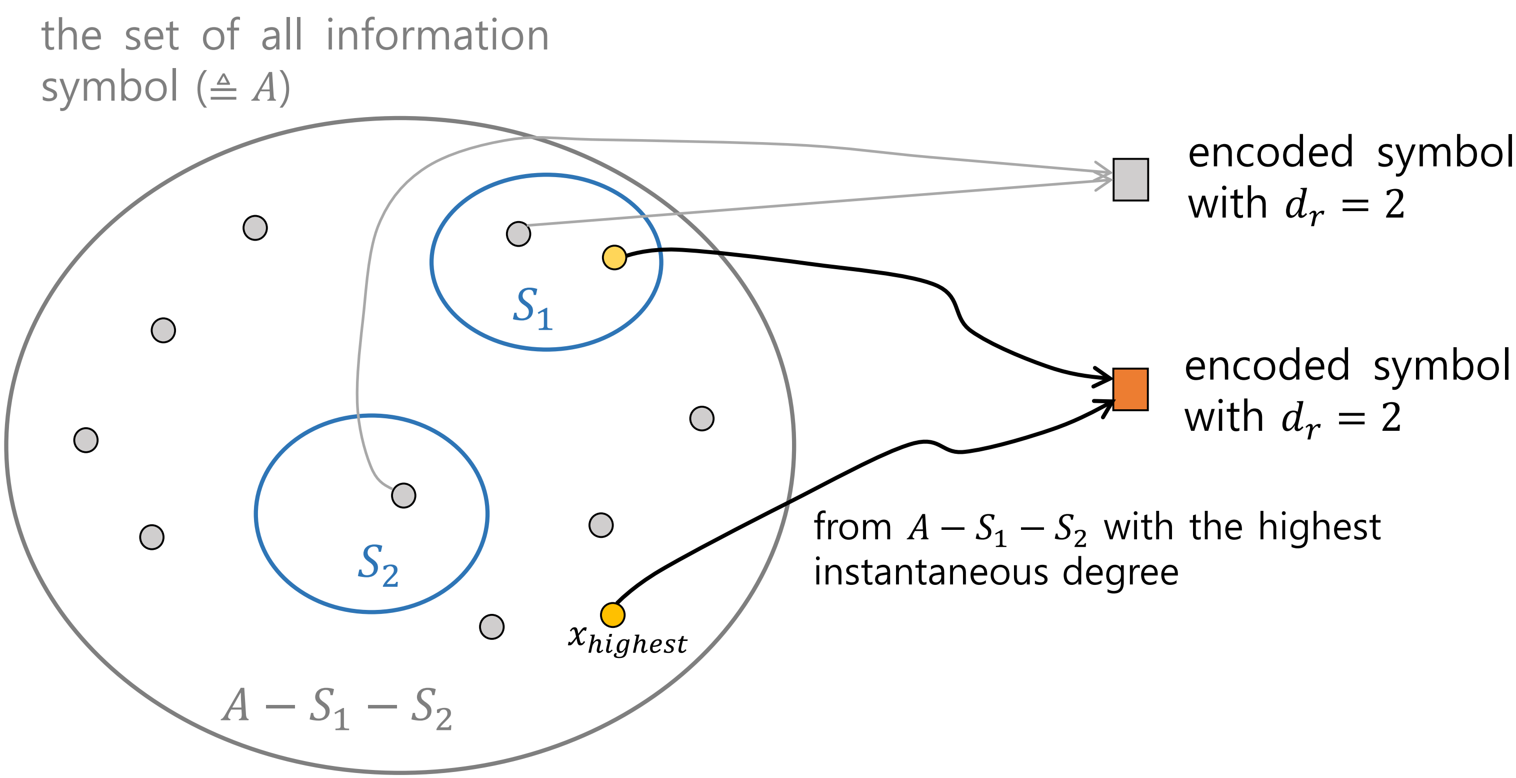

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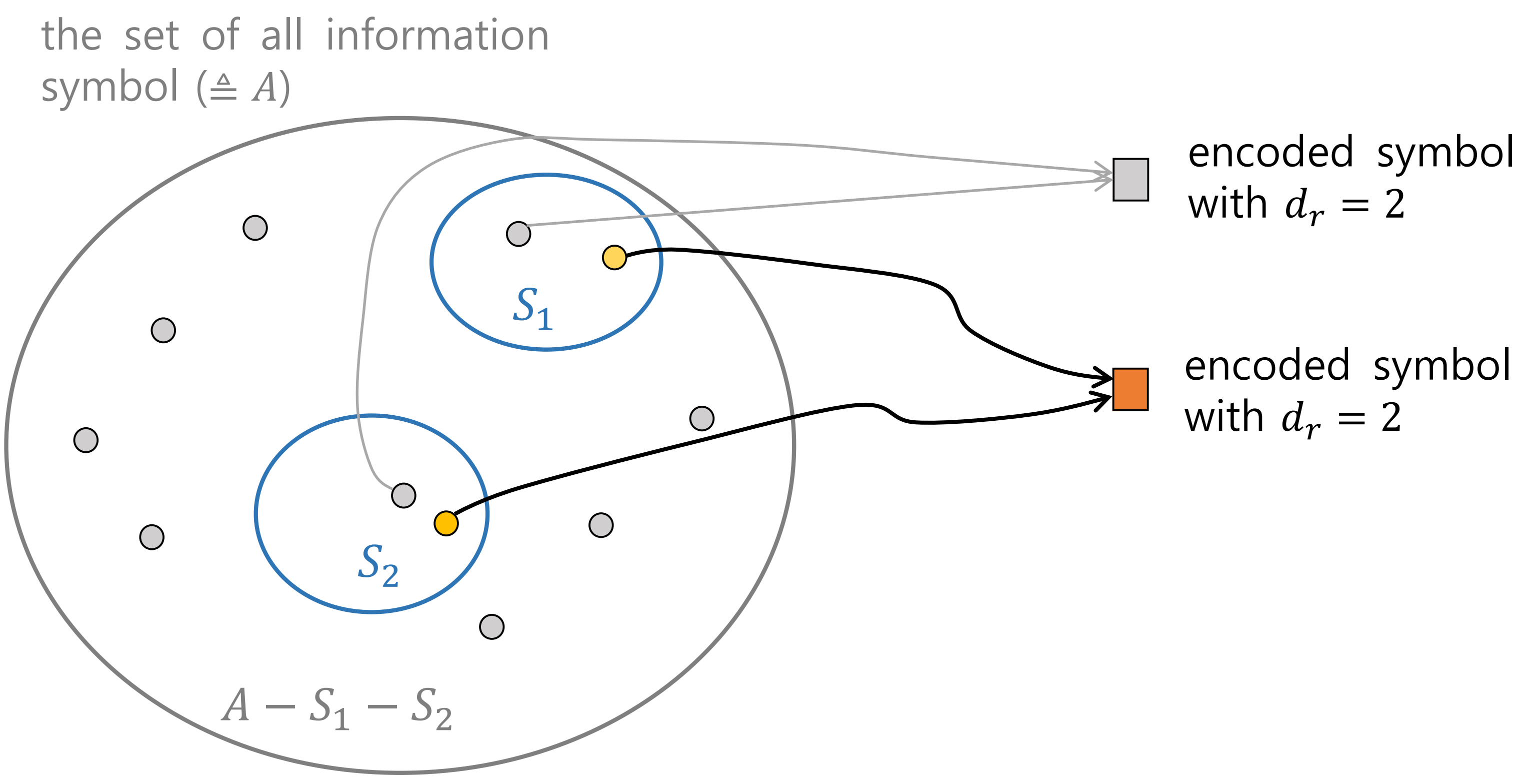

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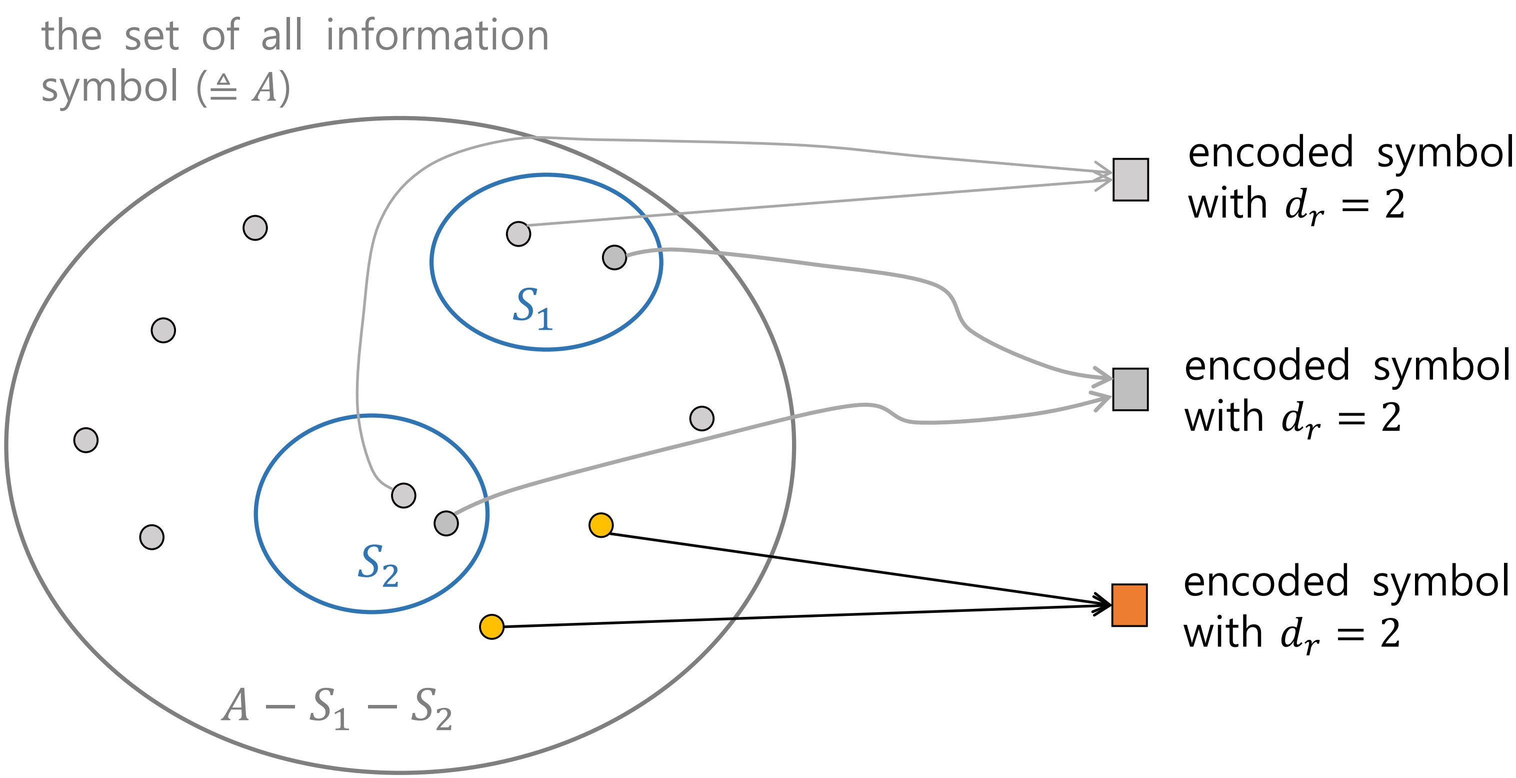
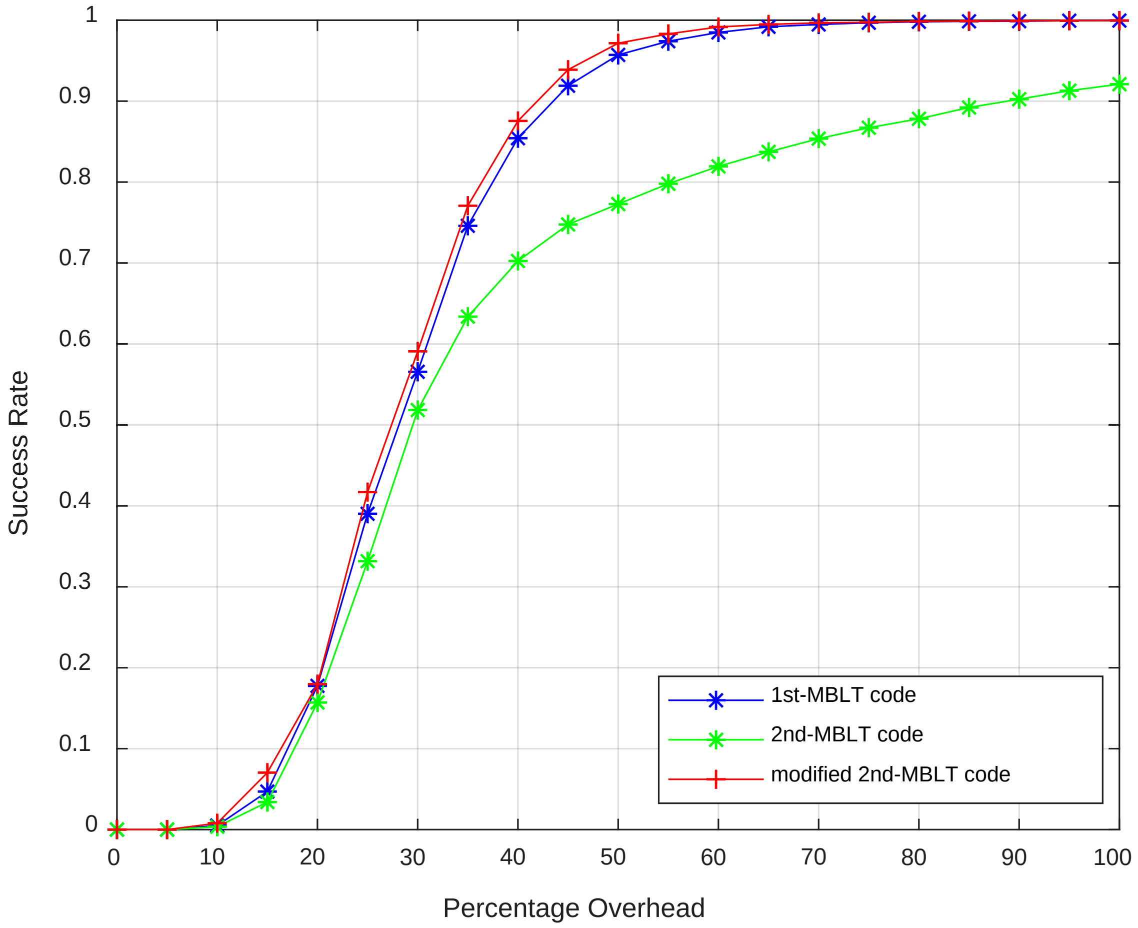


Simulation result



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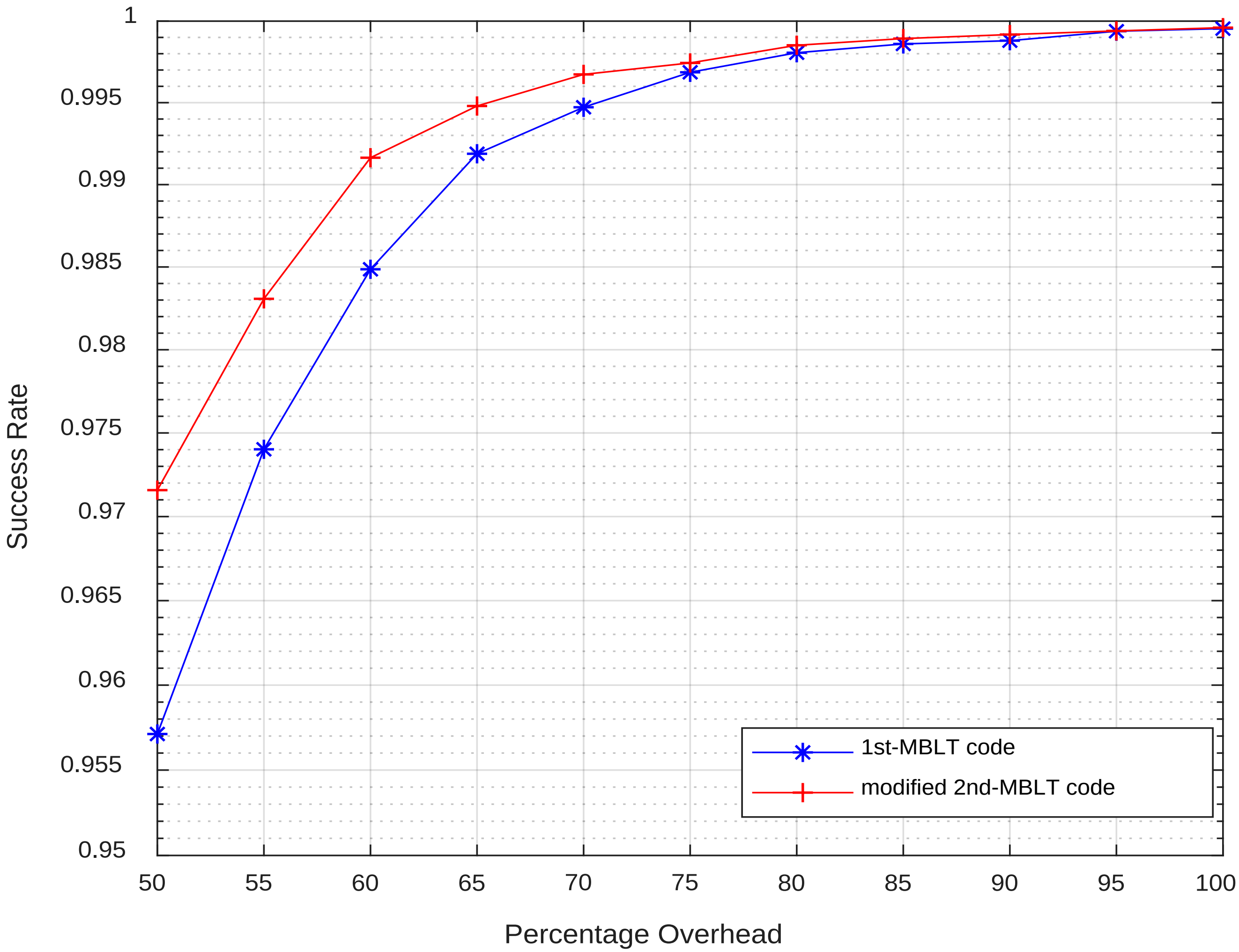

Question?