

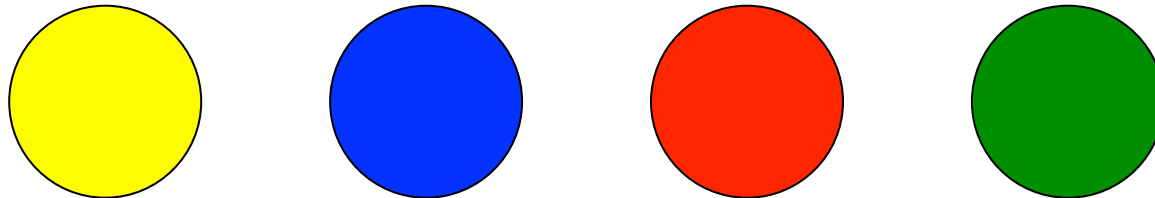
Exploring Optimization Strategies for *Mastermind*

Gioia Dominedò • Amy Lee • Kendrick Lo • Reinier Maat

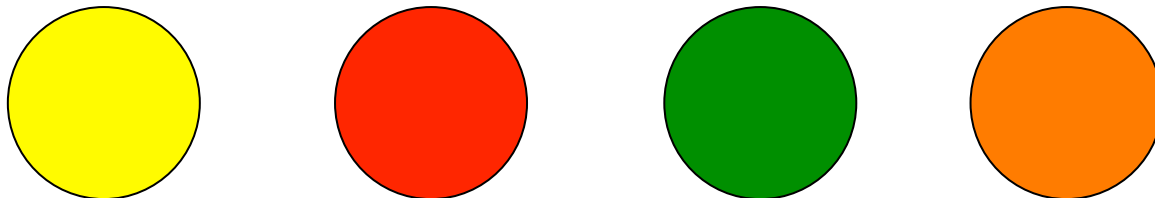
AM207 Final Project (2016)

MASTERMIND

Hidden code:



Example guess:



Response:

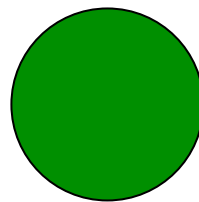
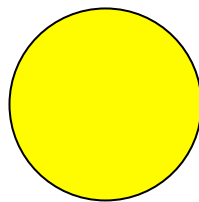
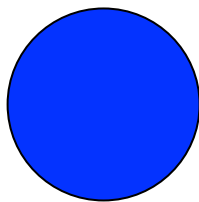
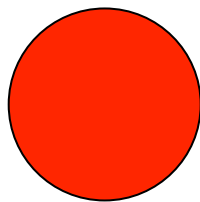
1 x ● 2 x ○

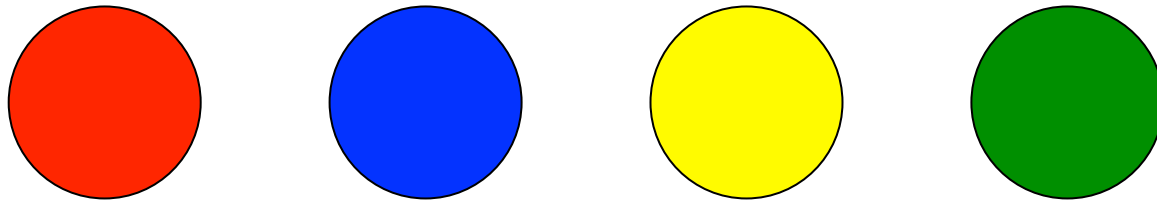
MASTERMIND

- Popular Strategies
 - Exclude all possibilities logically (Knuth's Algorithm)
 - Random Search
- Problems with popular strategies
 - Exhaustive search
 - Time and space requirements increase exponentially as the number of colors and/or positions increase

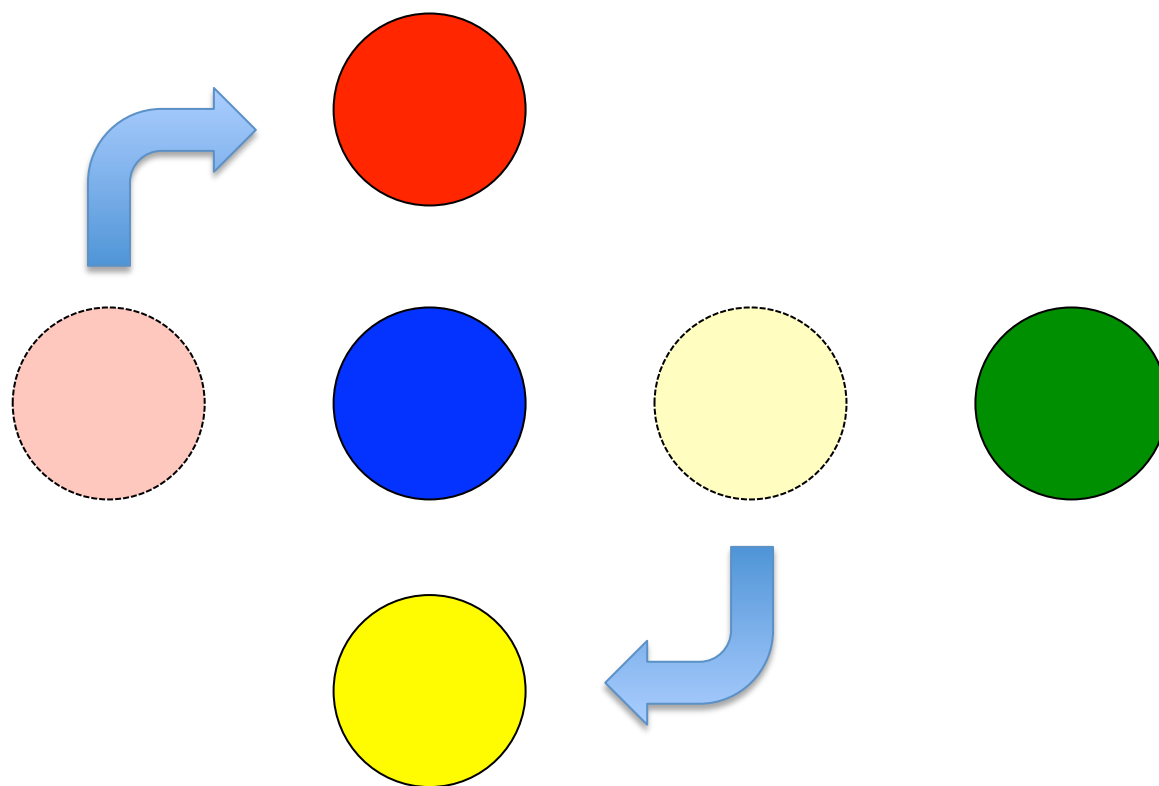


Credit: Steve Berry

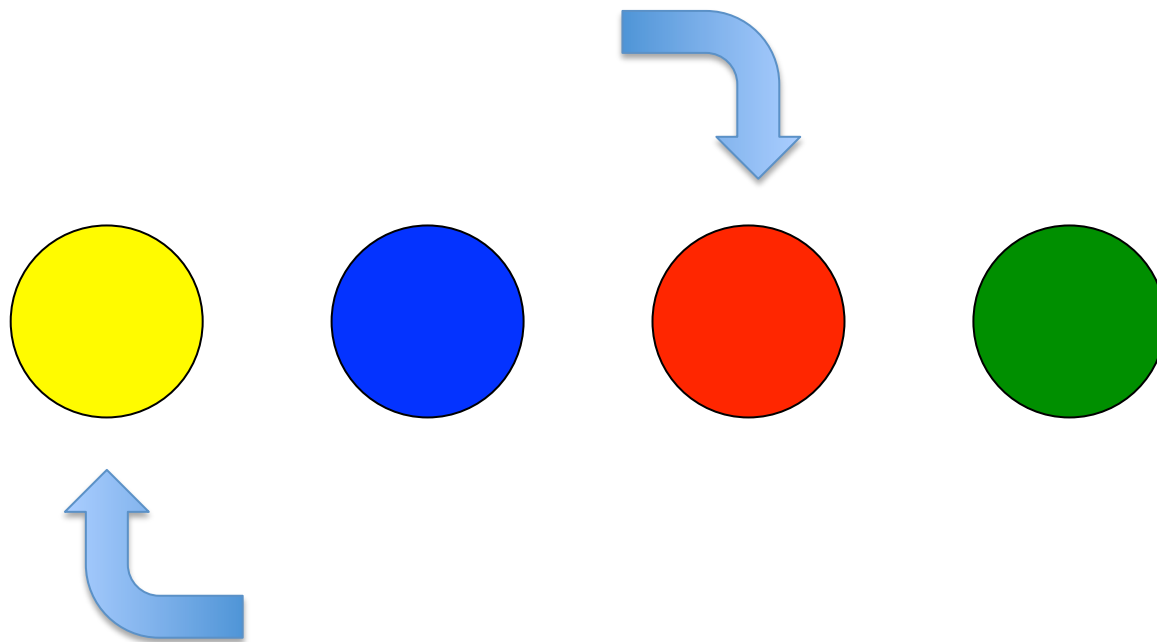




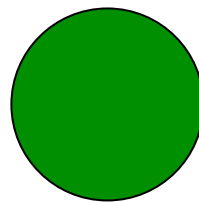
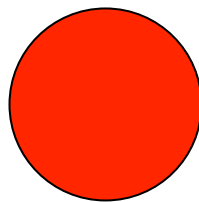
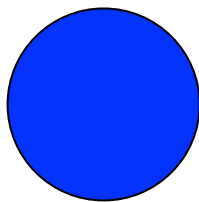
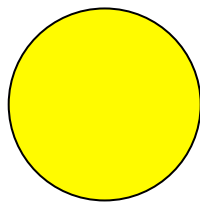
permutation

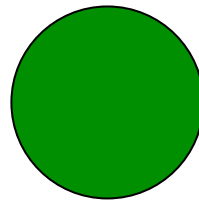
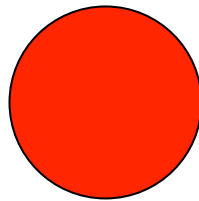
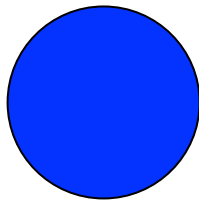
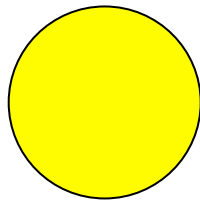


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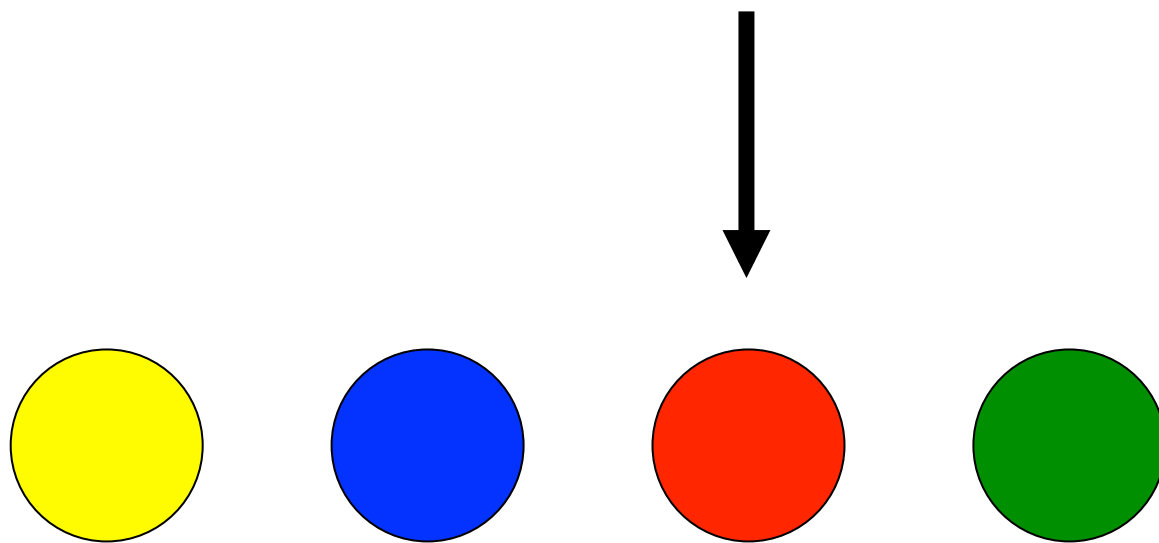


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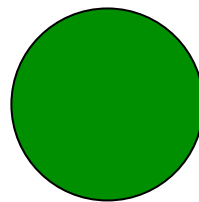
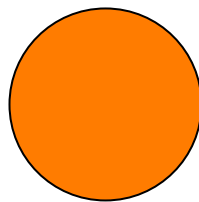
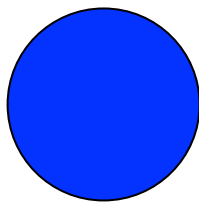
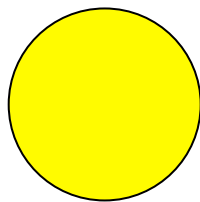




mutation

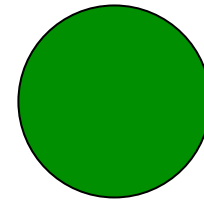
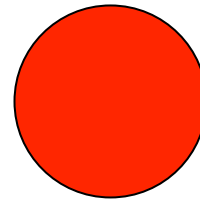
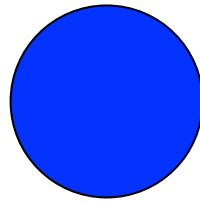
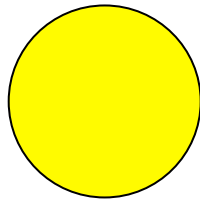
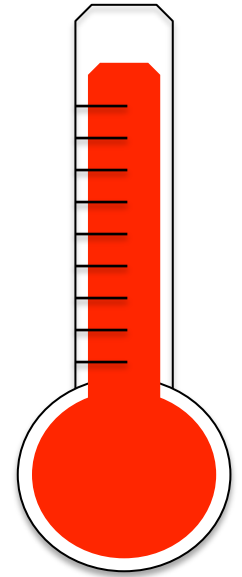


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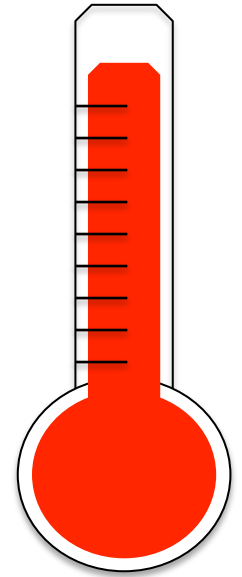
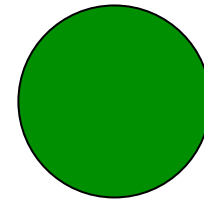
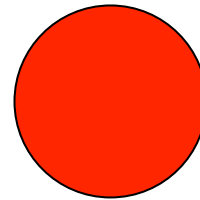
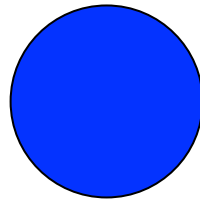
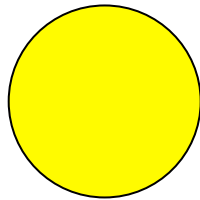


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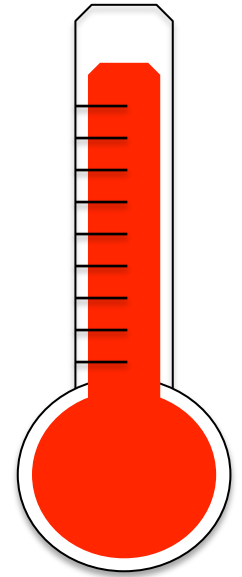
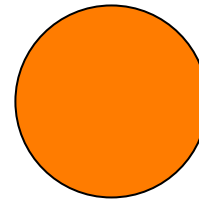
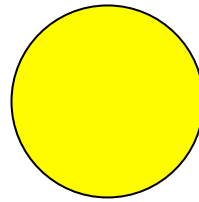
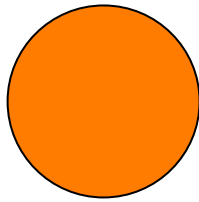
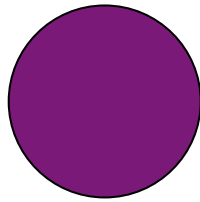
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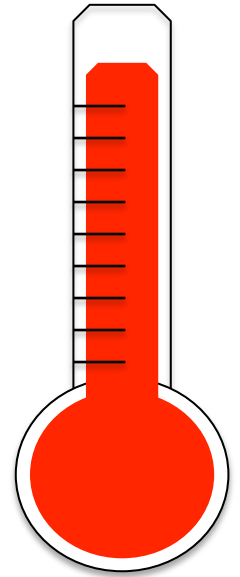
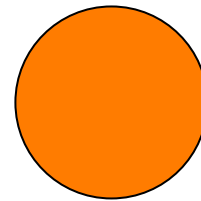
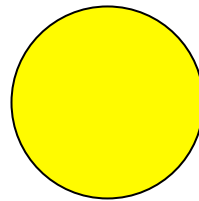
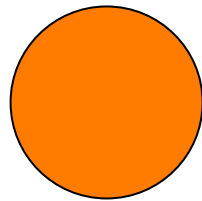
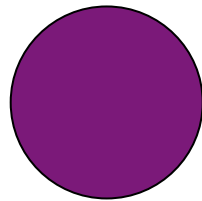
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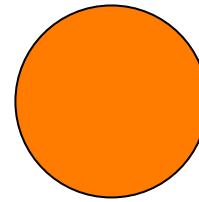
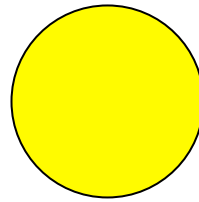
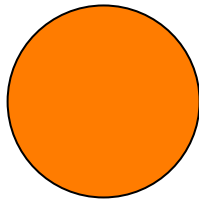
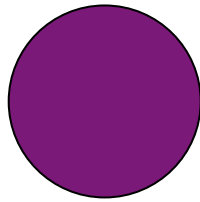
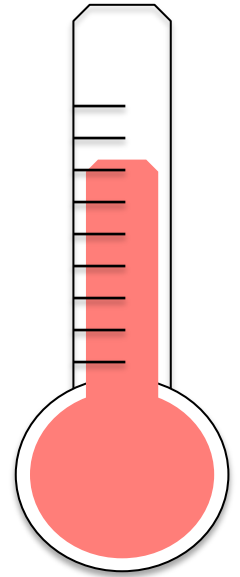
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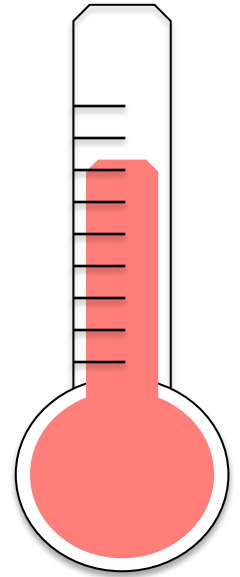
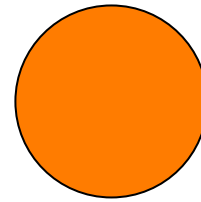
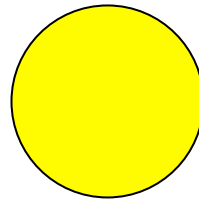
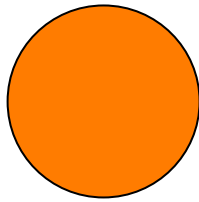
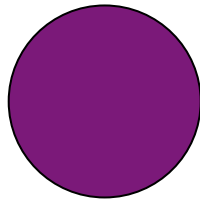
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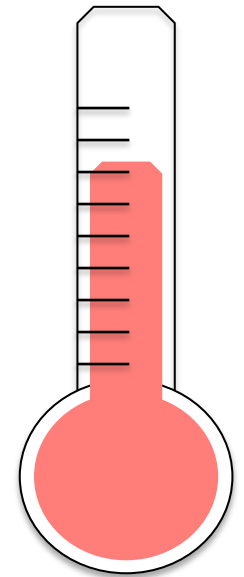
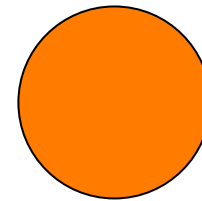
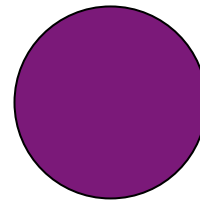
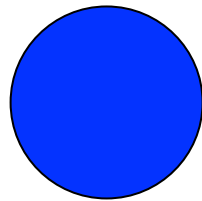
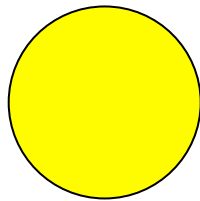
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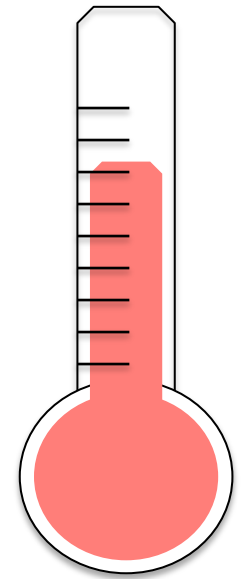
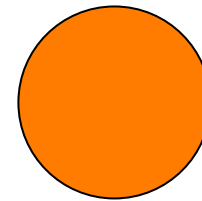
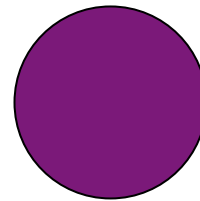
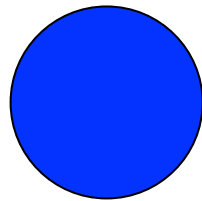
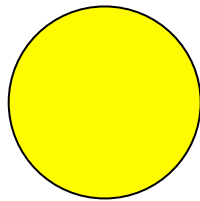
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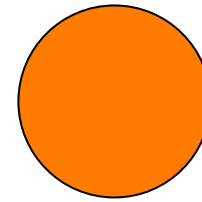
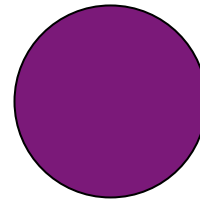
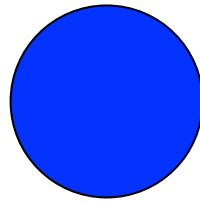
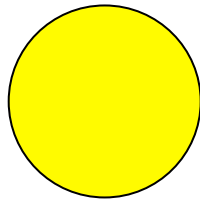
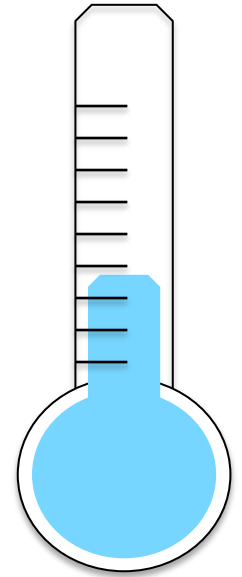
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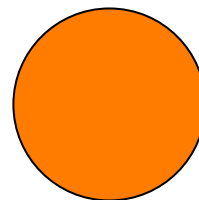
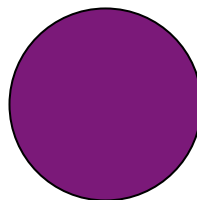
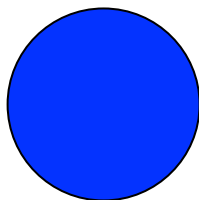
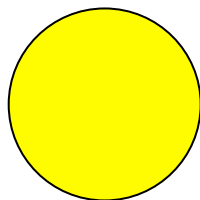
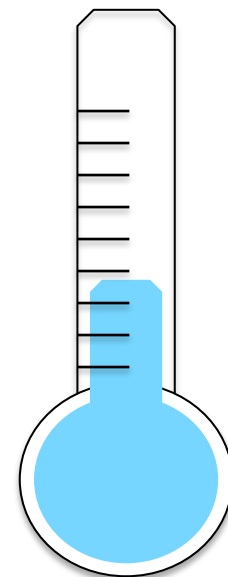
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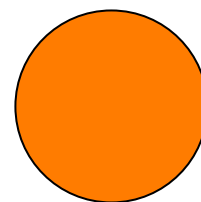
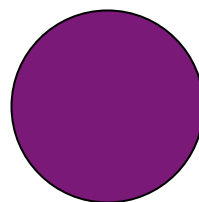
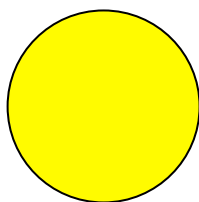
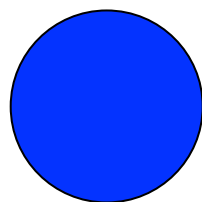
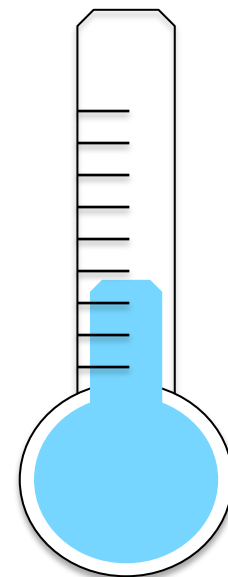
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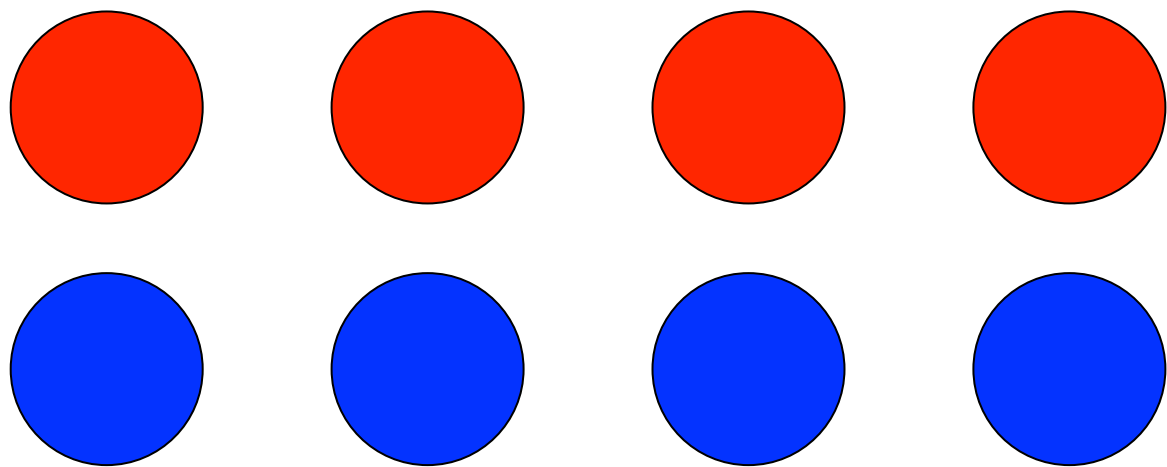


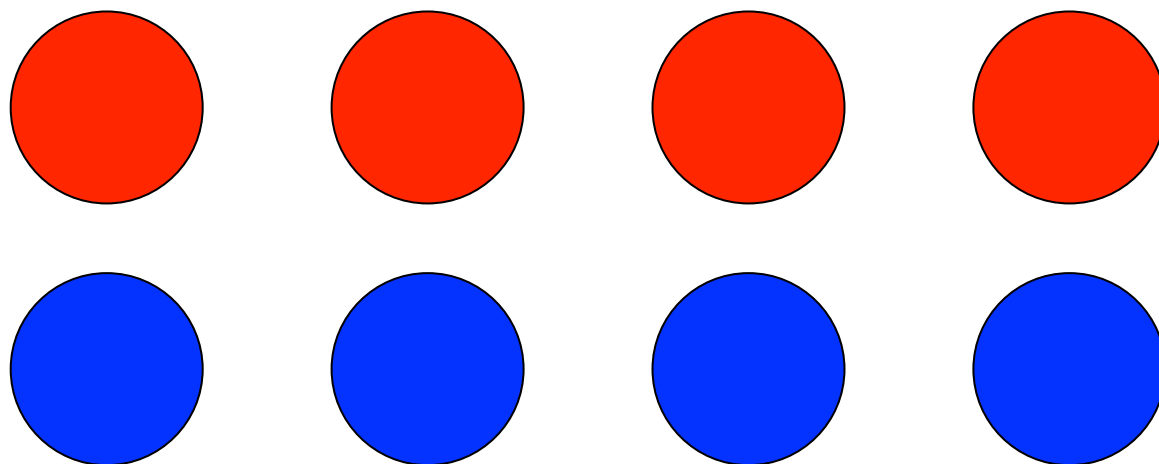
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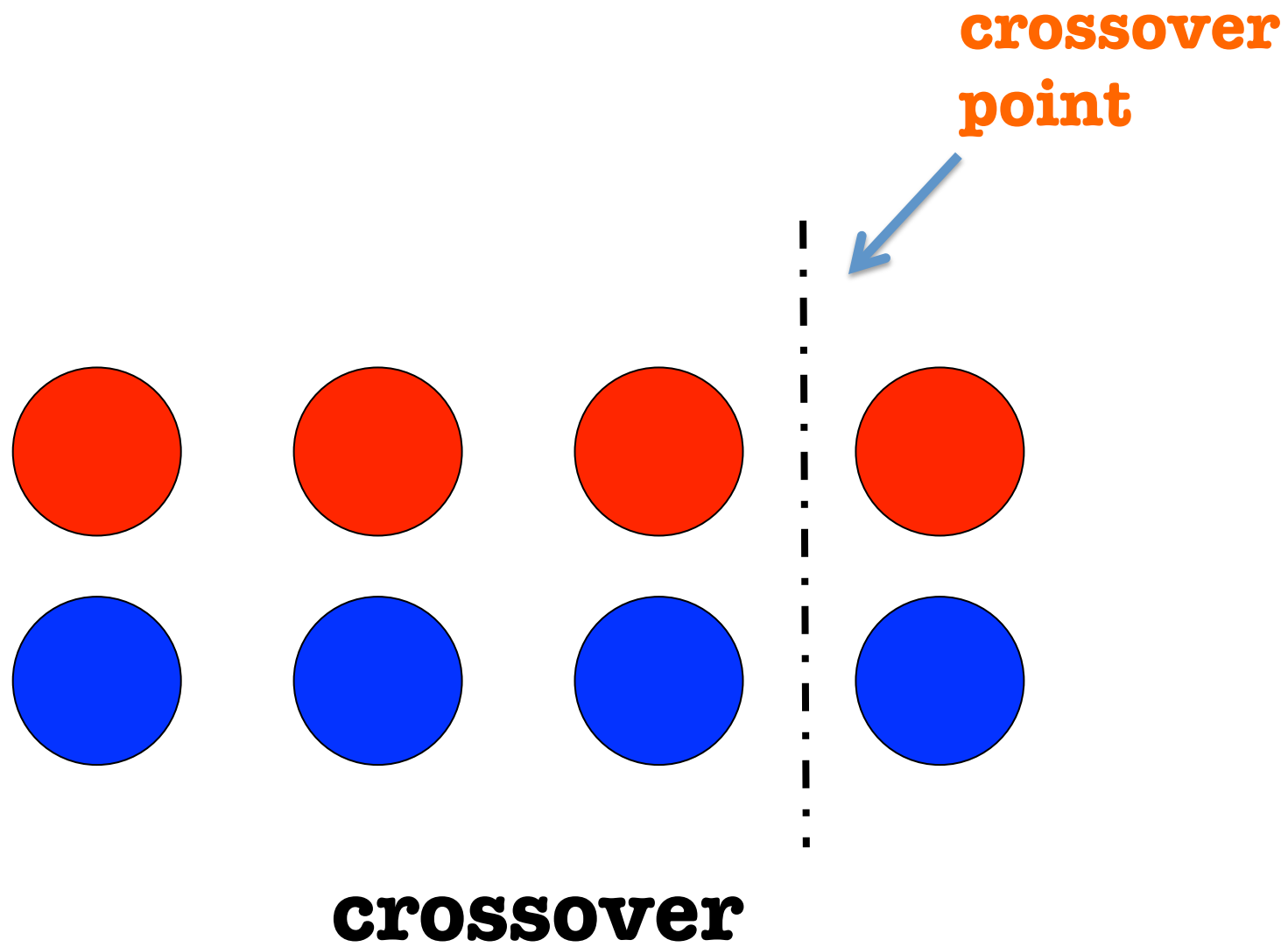
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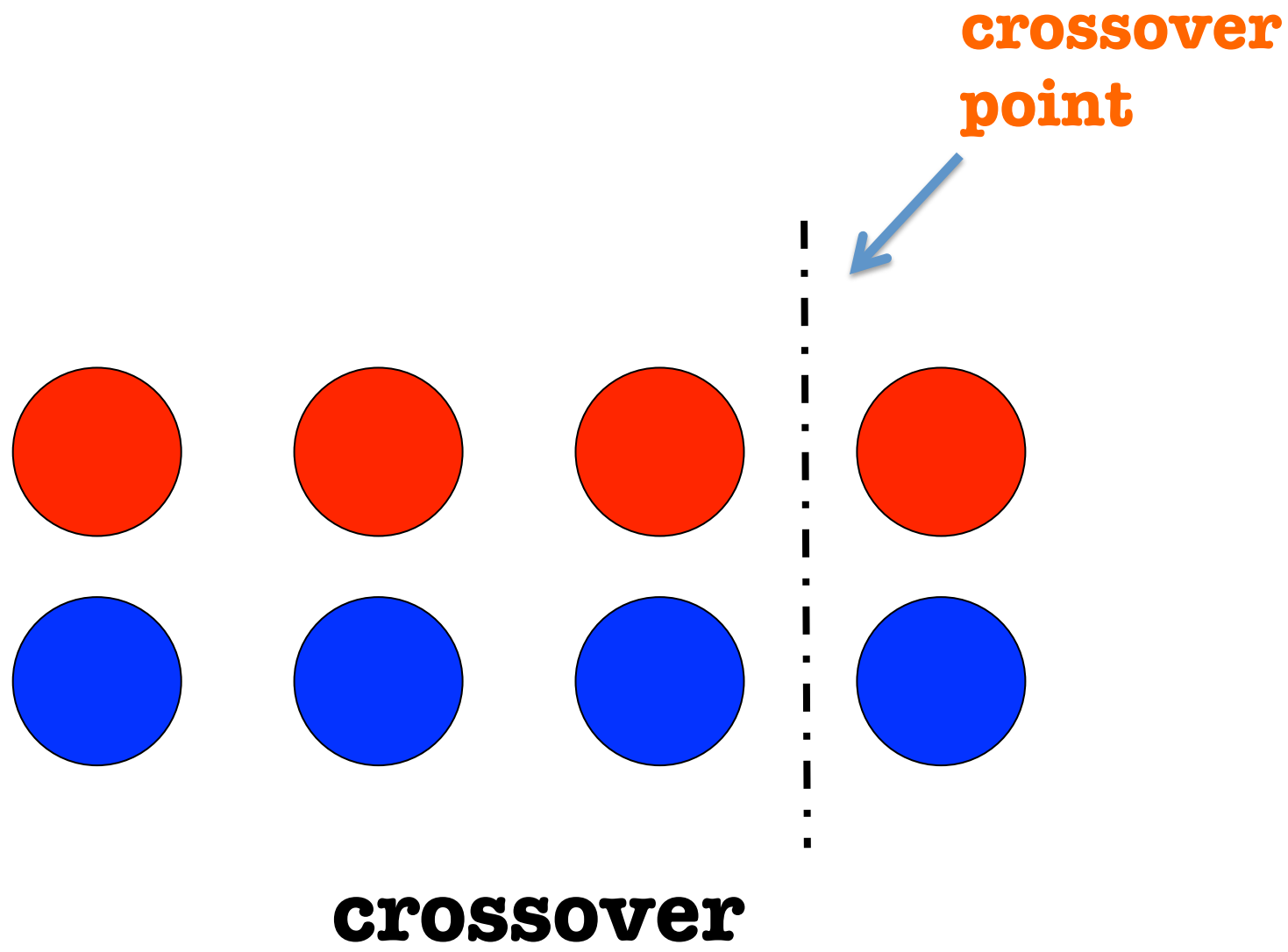


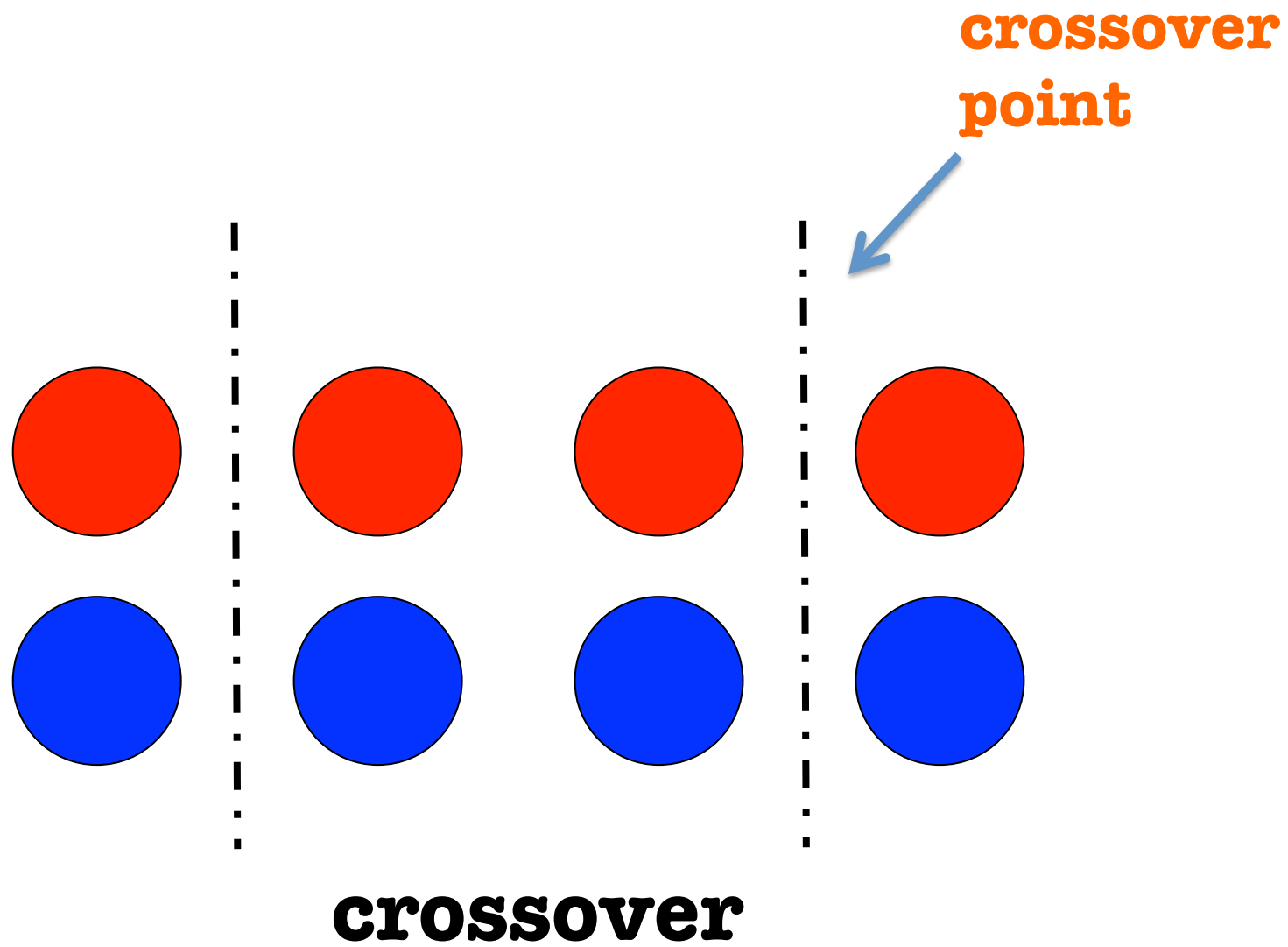


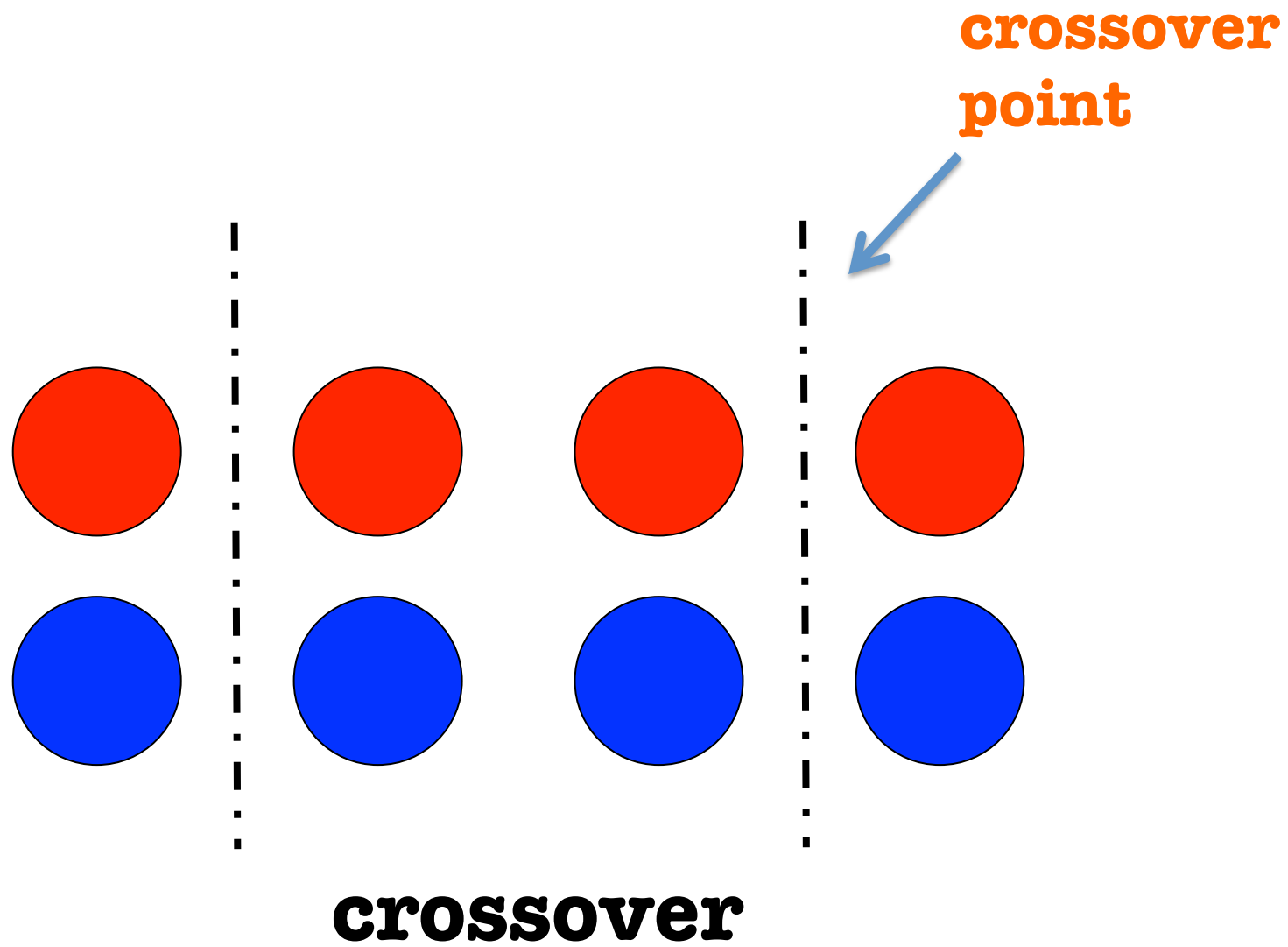


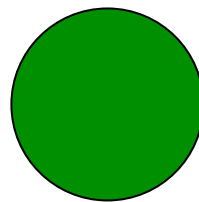
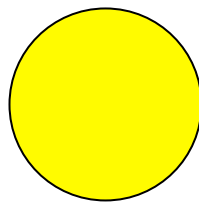
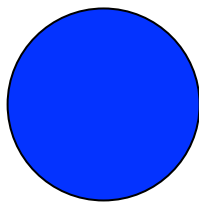
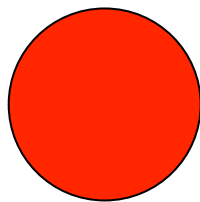
crossover

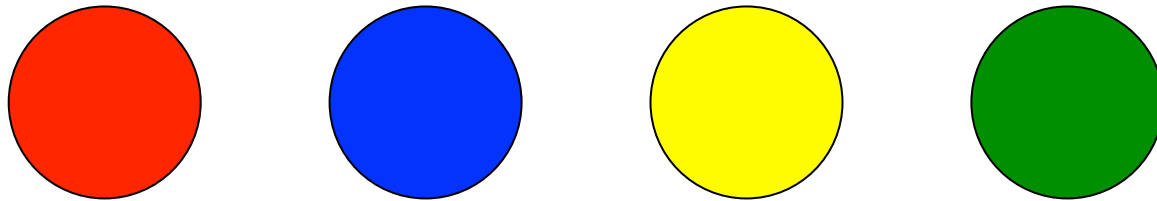




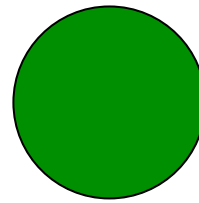
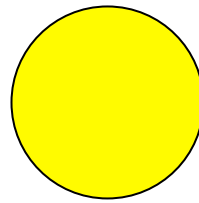
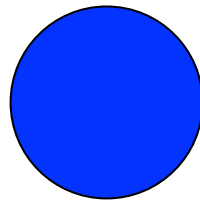
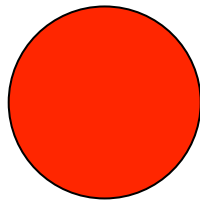




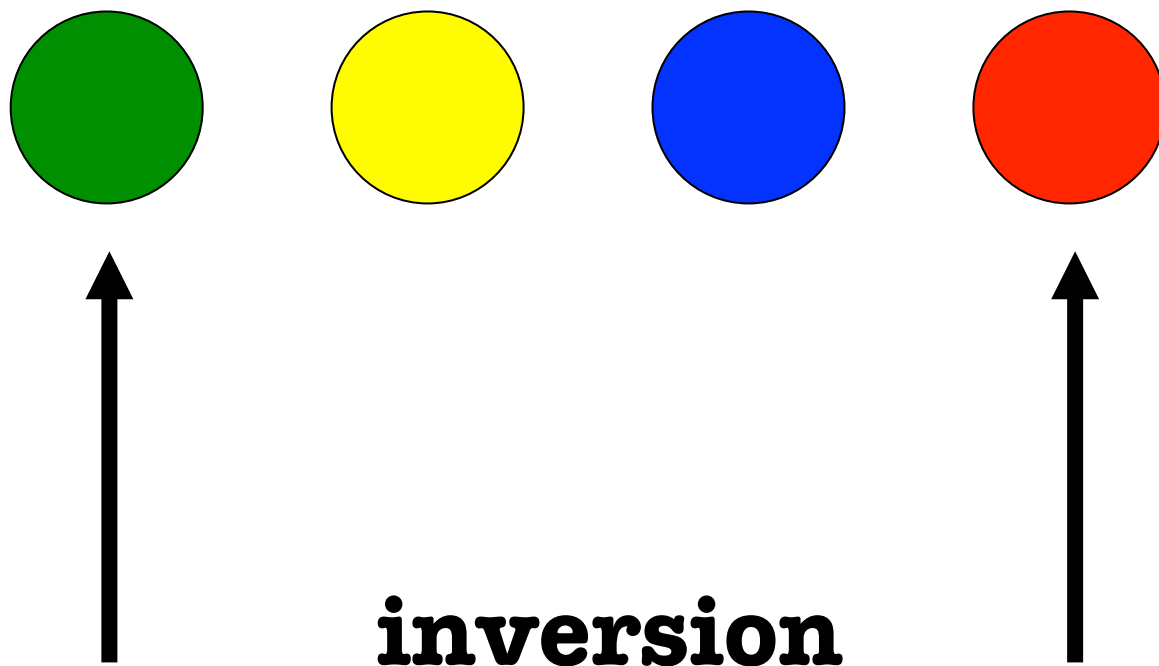




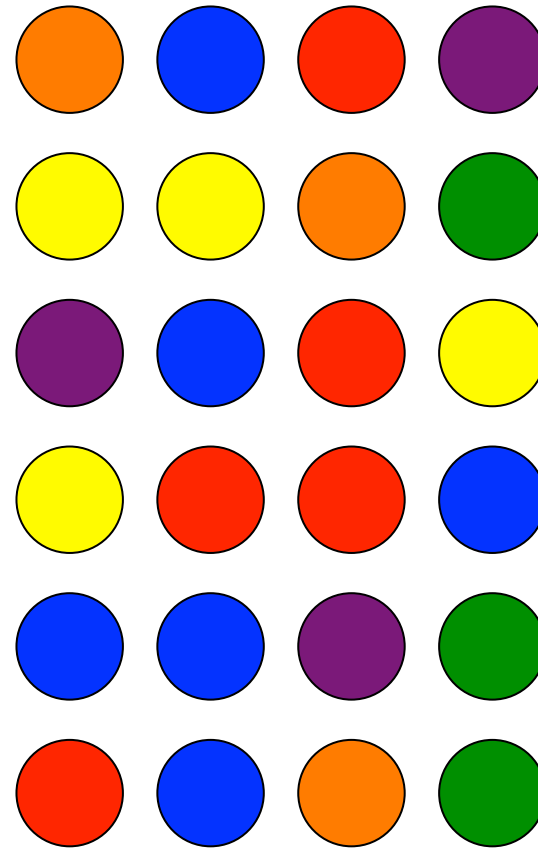
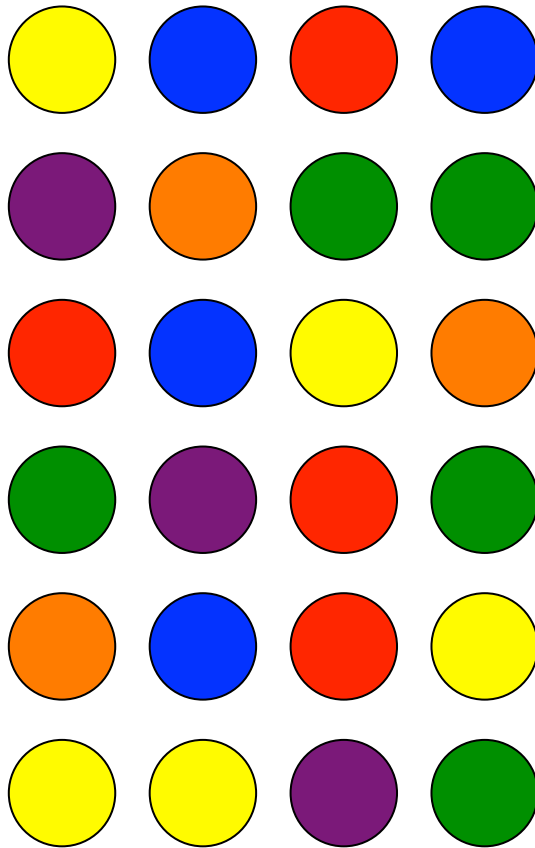
inversion



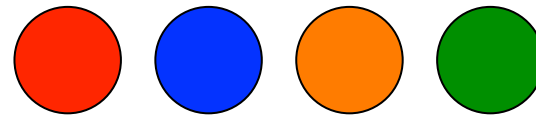
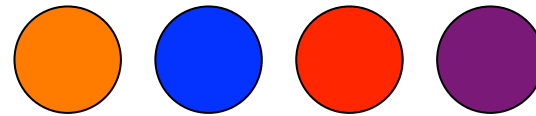
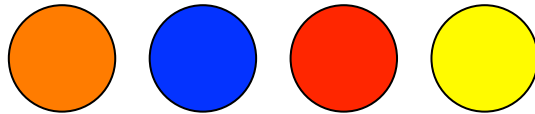
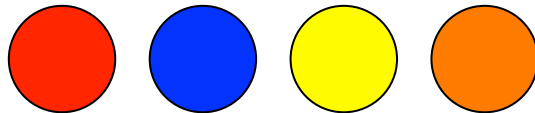
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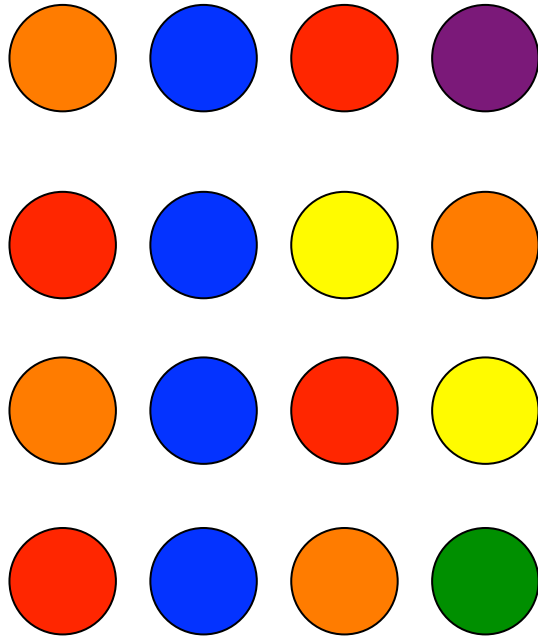
GENETIC ALGORITHMS



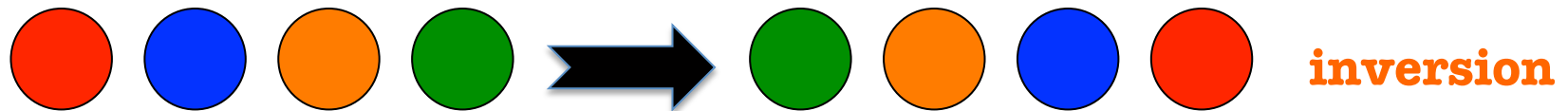
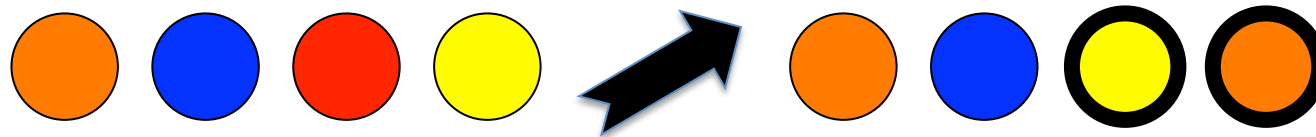
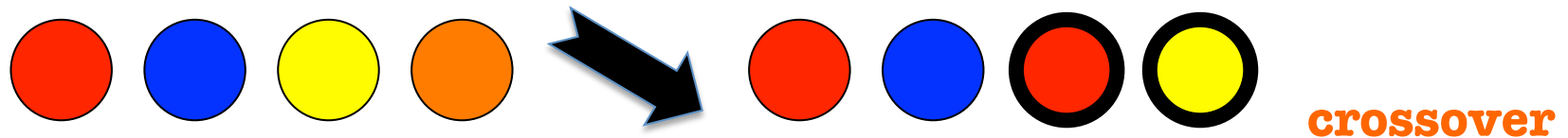
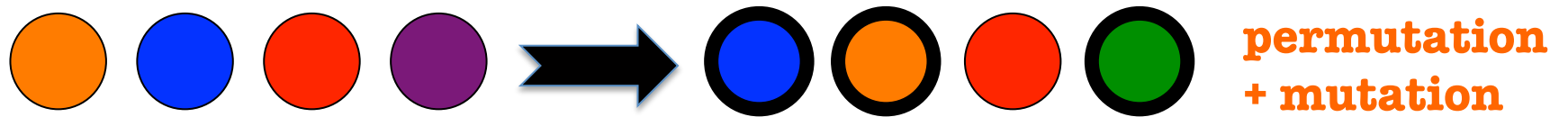
GENETIC ALGORITHMS



GENETIC ALGORITHMS

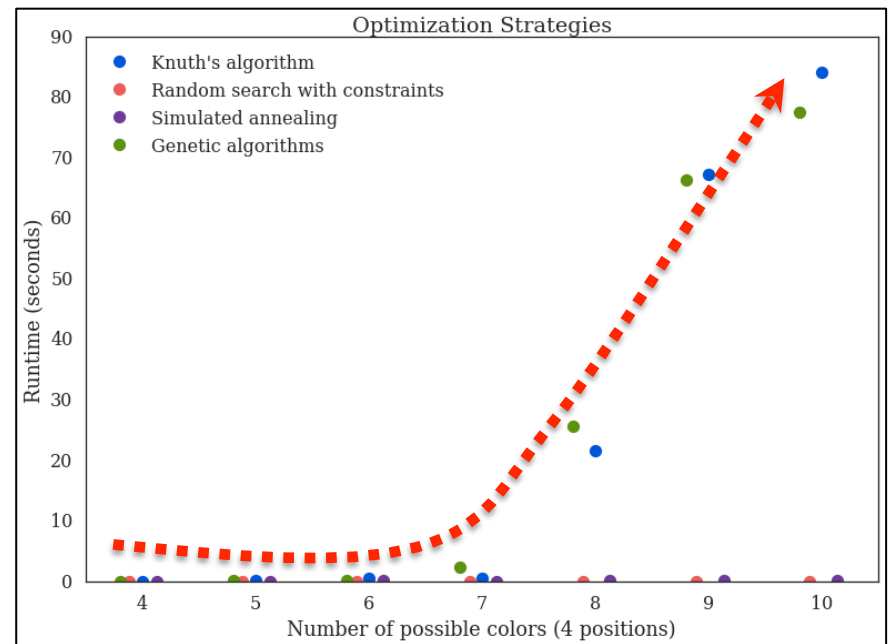


GENETIC ALGORITHMS



CONCLUSIONS

- Exhaustive strategies:
Colors \uparrow = Runtime $\uparrow \uparrow$
- Stochastic strategies:
 - Lower runtimes
 - Similar # of guesses
- Stochastic techniques make playing scaled-up Mastermind in finite time feasible



Thanks for watching!