Best Testcases Formulation

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Rachit, Liza

Problem Statement

Description

Currently, to test the Payoff Variation for various Autocall procedures, either the entire dataset is tested or the best testcases to test are intuitively chosen.

The task was to computationally formulate a method to select the best testcases that could represent the entire dataset.

| Sr. No	General Terms			Dates			AutoCall			AutoCall Coupon	Payoff at Maturity
	Format	Solve For	Public/Private	Strike Shift	Issue Date Offset	Tenor	Type	Autocall Freq.	AC From	Type	Prot. Type
1	Note	Reoffer (%)	Private Placement	Tdy	T+5		Constant Barrier	Daily	Y1	Flat	Am Daily Close
2	Note	Reoffer (%)	Private Placement	Fwd	Custom		Constant Barrier	Monthly	M1	Flat	Am Daily Close
3	Note	Reoffer (%)	Private Placement	Tdy	T+5		Constant Barrier	Quarterly	Q1	Flat	Am Daily Close
4	Note	Reoffer (%)	Private Placement	Fwd	T+10		Constant Barrier	Semiannually	S1	Flat	Am Daily Close
5	Note	Reoffer (%)	Private Placement	Fwd	Custom		Constant Barrier	Annually	Y1	Flat	Am Daily Close
6	Note	Reoffer (%)	Private Placement	Tdy	T+5		Constant Barrier	Daily	Y1	Snowball	Am Daily Close

Concepts Used & Approach

Kullback–Leibler divergence

A measure of how different a probability P is from a second probability Q.

$$D_{KL}(P||Q) = \sum_i P(i) \log \frac{P(i)}{Q(i)}$$

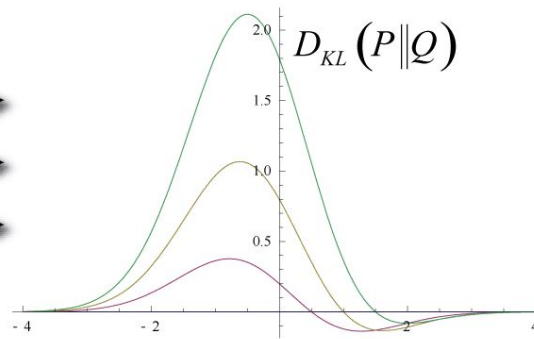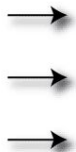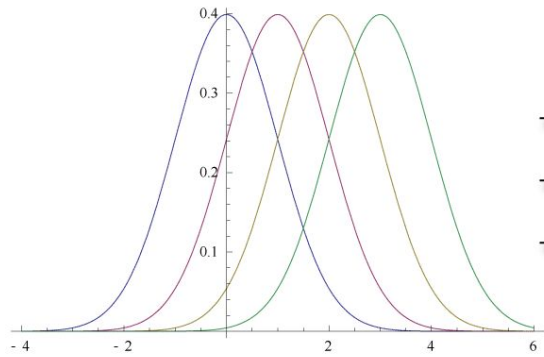$$D_{KL}(P||Q) = \int P(x) \log \frac{P(x)}{Q(x)} dx$$
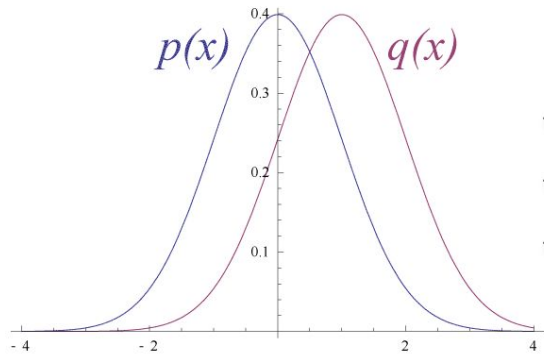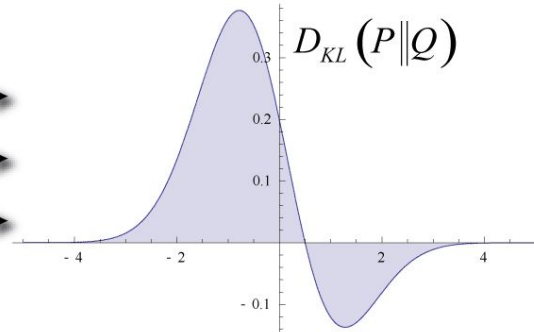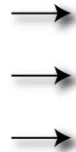
Illustration of the relative entropy for two normal distributions. The typical asymmetry is clearly visible.

Model Distribution (q(s))

```
solve_for,Reoffer (%),1
solve_for,Autocall Coupon (%),1
placement,Private Placement,1
placement,Public Placement,1
strike_shift,Fwd,0.2
strike_shift,Tdy,0.8
issue_date,T+5,0.25
issue_date,T+10,0.25
issue_date,Custom,0.5
ac_type,Variable Barrier,1
ac_type,Constant Barrier,1
ac_freq,Daily,0.5
```

Genetic Algorithm

The genetic algorithm is a method for solving optimization problems that is based on **natural selection.**
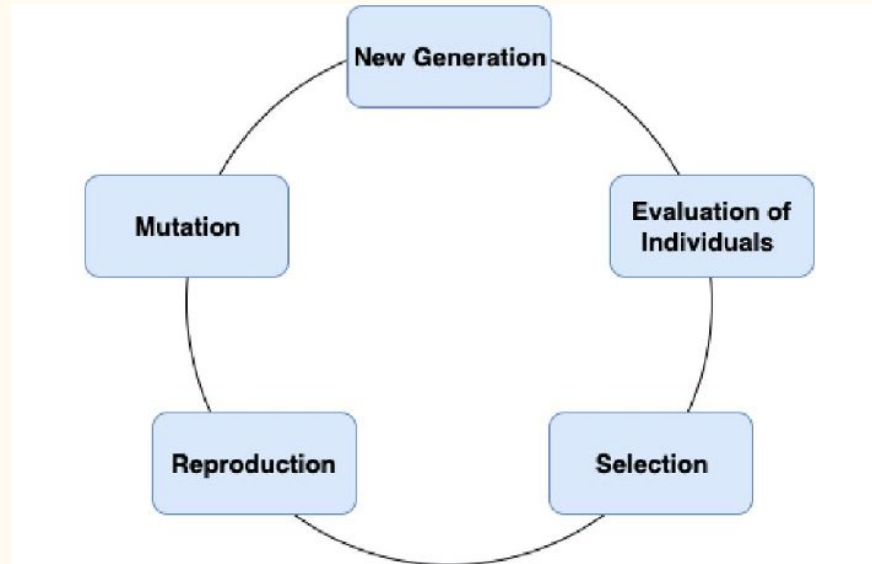
Tournament Selection
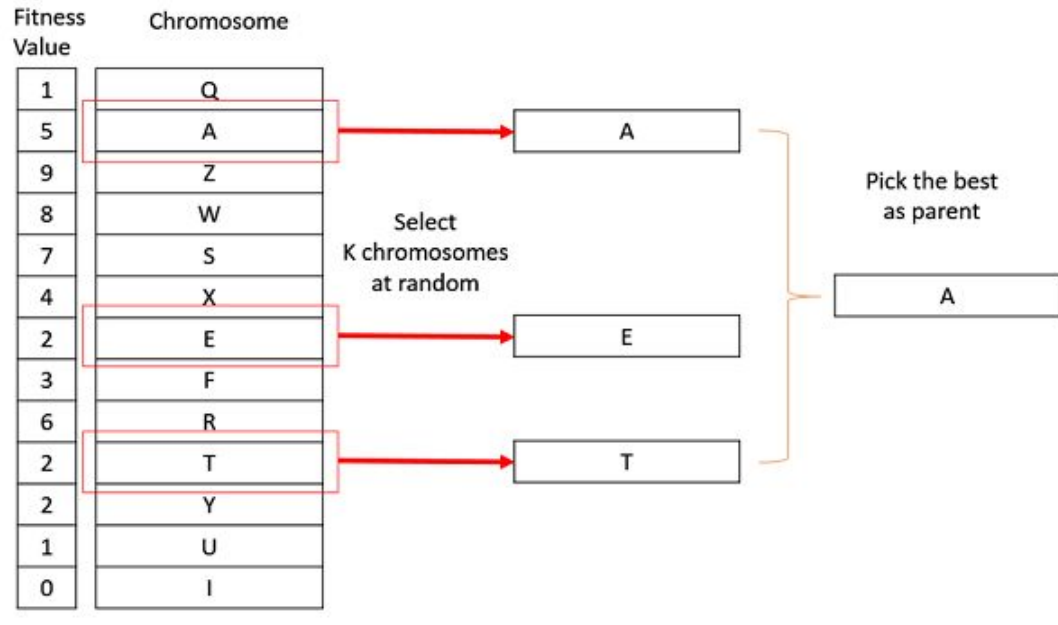
Crossover

Chromosome1	11011|00100110110
Chromosome2	11011|11000011110
Offspring1	11011|11000011110
Offspring2	11011|00100110110

Single Point Crossover
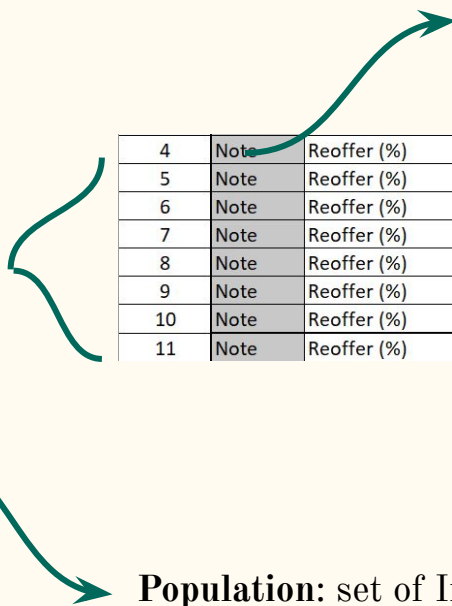
Mutation

Before Mutation

| F | G | H | B | C | D | E | A |

After Mutation

| F | G | M | B | C | D | E | N |

How does a population look for us?

Single Testcase: set of features

Individual:
set of
testcases
randomly
chosen

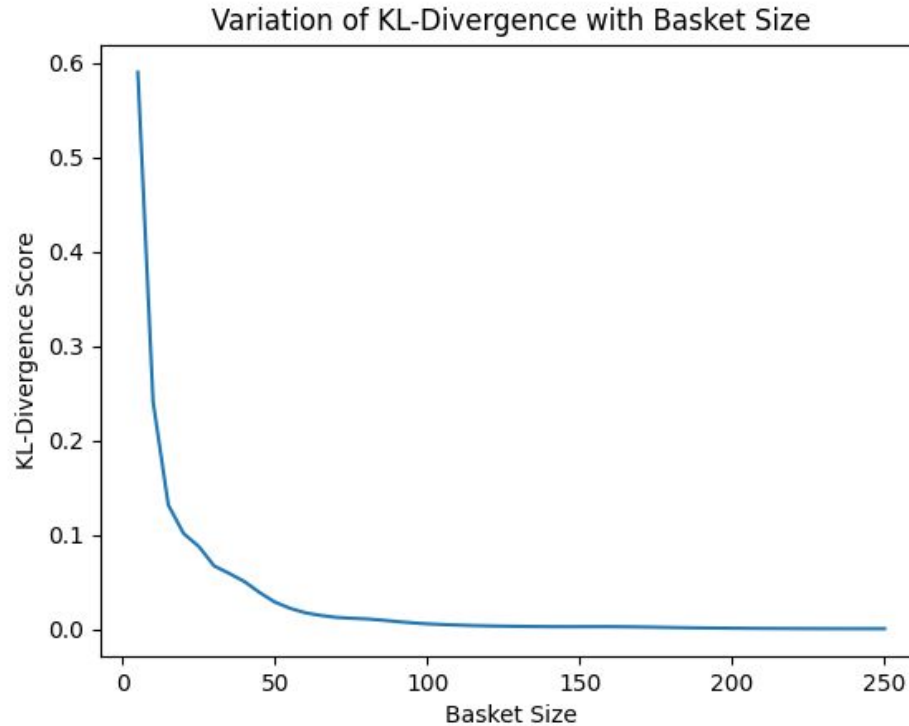|										
4	Note	Reoffer (%)	Private Placement	Fwd	T+10		Constant Barrier	Semiannually	S1	Flat	Am Daily Close
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10	Note	Reoffer (%)	Private Placement	Fwd	Custom		Constant Barrier	Annually	Y1	Snowball	Am Daily Close
11	Note	Reoffer (%)	Private Placement	Tdy	T+5		Constant Barrier	Daily	Y1	Flat	Am Intraday

Population: set of Individuals

Results for Standard Autocall

Variation of Best Testcases for Bucket Size = 5 to 250

Open for Questions!