On Compile Time Knuth-Morris-Pratt Precomputation

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Prague Stringology Conference 2011

Outline

1 The General Idea

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2. Experiment
   - Benchmark Requirements
   - Implementation Experience

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   - Theoretical Speculation
   - Results and Observations

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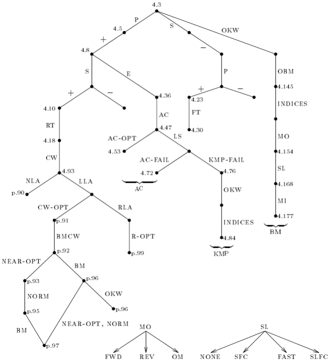
4. Final Remarks

Taxonomological Optimization Targets[?]



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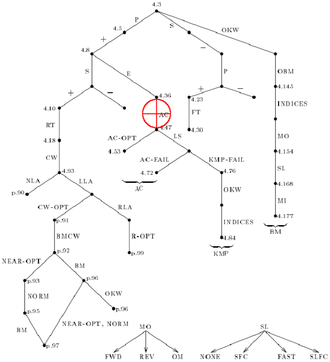

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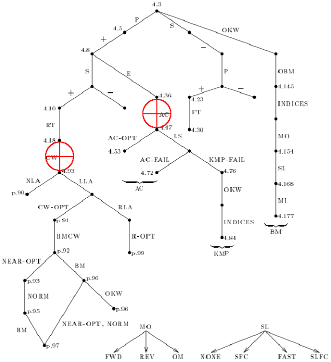

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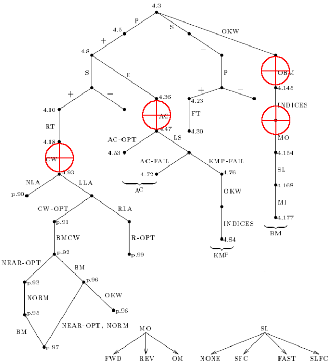

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- Start as *simply* as possible
- Primary aim was probatory research

Design Overview

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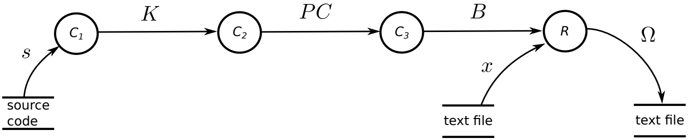
Run time requirements

- Benchmark the following using some target text (x)
  - Traditional (non optimised) KMP
  - Optimised KMP
  - Precomputation algortihm at runtime

A Pipelined Approach



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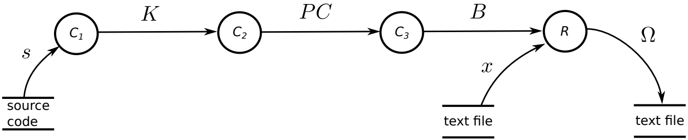

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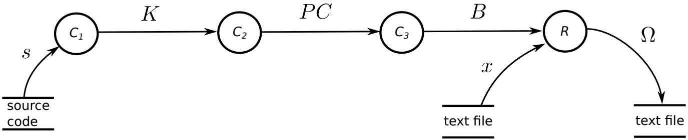

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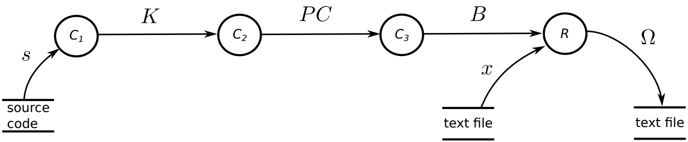

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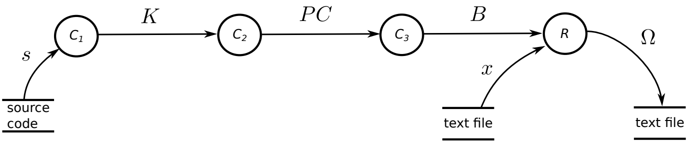

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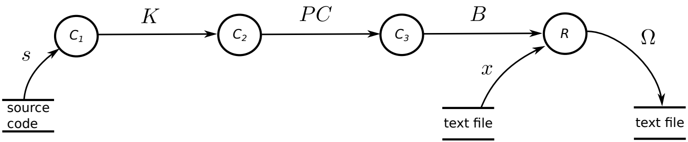

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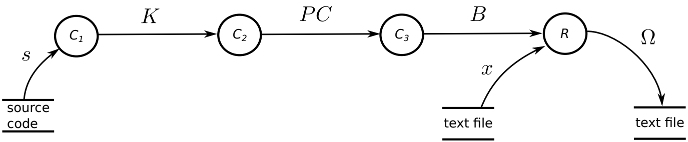

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- Allowed focus to be on implementation and analysis (not design paralysis)
- Not ideal, can be improved

C++

Eventualy Hit a Dead End

Severe Metaprogramming Constraints

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- Variadic compile time array initialisation

```
fail_idx[] = { precomp<k>::compute };
// i.e., int foo = { 0, 0, 1, ...  }
```

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Addresses all problems encountered in C++ (length, computation, writability, array initialisation).

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- Compile Time Function Evaluation

Hypotheses

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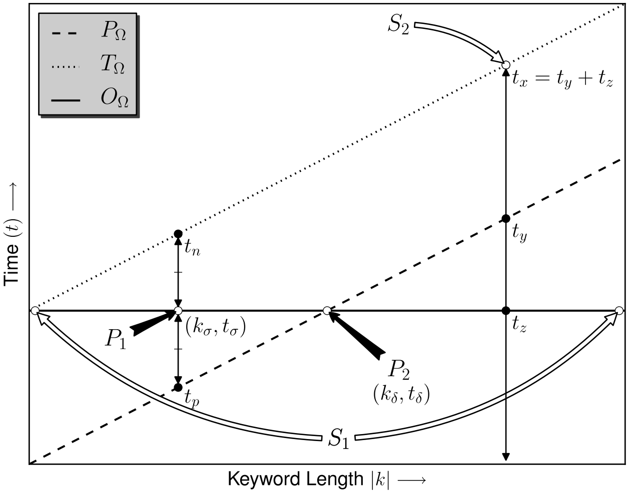
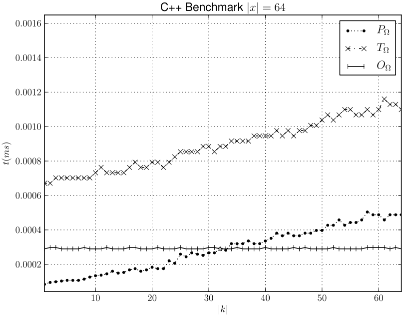
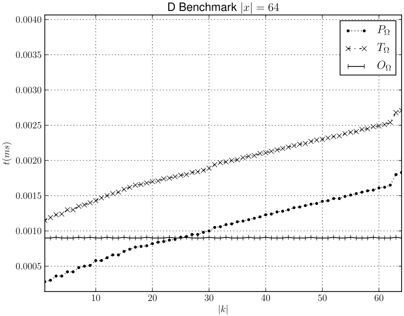

P_Ω
T_Ω
O_Ω
S_2
$t_x = t_y + t_z$
t_y
t_n
(k_σ, t_σ)
P_1
t_z
P_2
(k_δ, t_δ)
t_p
S_1
Time (t) ⟶
Keyword Length $|k|$ ⟶

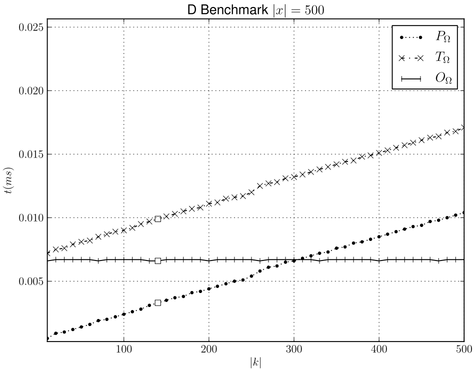
C++ VS D
A Limited Comparison





Interpeting D Data

When can we justify Compile Time Optimizations?



- Strong case for optimized search observed where $|k| \geq \approx \frac{|x|}{4}$

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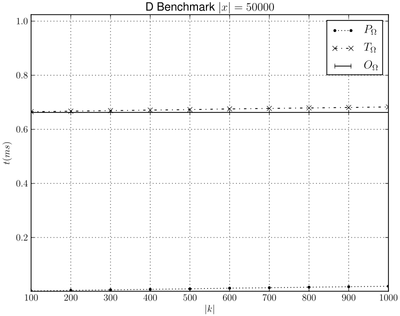
When is Compile Time Optimizations Redundant?



- Optimized search gains neared redundancy where $|k| \leq \approx \frac{|x|}{50}$

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- Choose a language designed for string metaprogramming
- General idea of the benchmark's design

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- ...and of course questions! $=/$