BioInspired Computing

Natural Computing Homework

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Document Preparation and Updates

Current Version [X.X.X]

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Revision History

Date	***Author***	***Version***	***Comments***
2/2/15	*Team Member #1*	*1.0.0*	*Initial version*
3/4/15	*Team Member #3*	*1.1.0*	*Edited version*

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Evolutionary Algorithms - Text Chapter 3

1.1 Problem 1

Implement the various hill-climbing procedures and the simulated annealing algorithm to solve the problem exemplified in Equation 1.1. Use a real-valued representation scheme for the candidate solutions (variable x).

By comparing the performance of the algorithms, what can you conclude?

For the simple hill-climbing try different initial configurations as attempts at finding the global optimum. Was this algorithm successful?

Discuss the sensitivity of all the algorithms in relation to their input parameters.

$$g(x) = 2^{-2((x-0.1)/0.9)^2} * \sin(5\pi x)^6 \tag{1.1}$$

1.2 Problem 2

Implement and apply the hill-climbing, simulated annealing, and genetic algorithms to maximize function $g(x)$ used in the previous exercise assuming a bitstring representation.

Tip: The pertubation to be introduced in the candidate solutions for the hill-climbing and simulated annealing algorithms may be implemented similarly to the point mutation in genetic algorithms. Note that in this case, no concern is required about the domain of x, because the binary representation already accounts for it.

Discuss the performance of the algorithms and asses their sensitivity in relation to the input parameters.

1.3 Problem 7

Determine, using genetic programming (GP), the computer program (S-expression) that produces exactly the outputs presented in Table 3.3 for each value of x. The following hypotheses are given:

- **Use only functions with two arguments (binary trees).**
- **Largest depth allowed for each tree: 4**
- **Function set: F = +, ***
- **Terminal set: T = 0, 1, 2, 3, 4, 5, x**

x	Program output
-10	153
-9	120
-8	91
-7	66
-6	45
-5	28
-4	15
-3	6
-2	1
-1	0
0	3
1	10
2	21
3	36
4	55
5	78
6	105
7	136
8	171
9	210
10	253

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Artificial Neural Networks - Text Chapter 4

3

Swarms - Text Chapter 5

4

Immunocomputing - Text Chapter 6

5

Latex

Big ole grab bag of latex sample code ....

5.1 Some LaTeX

See Figure 5.1. This is a floating figure environment. LaTeX will try to put it close to where it was typeset but will not allow the figure to be split if moving it can not happen. Figures, tables, algorithms and many other floating environments are automatically numbered and placed in the appropriate type of table of contents. You can move these and the numbers will update correctly.

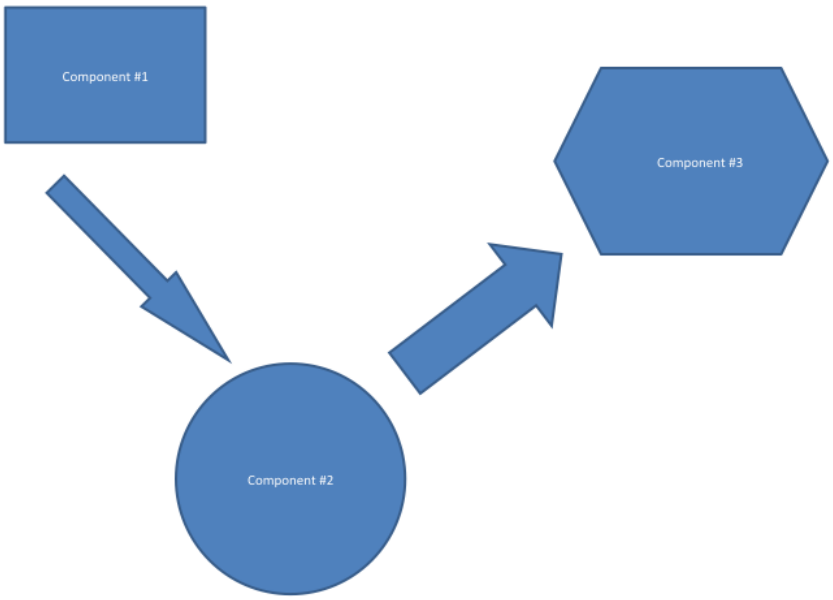

Figure 5.1: A sample figure .... System Diagram

See Table 5.1. This is a floating table environment. LaTeX will try to put it close to where it was typeset but will not allow the table to be split.

Sample bullet list environment:

- According to the all knowing wikipedia, C is an all purpose imperative programming language.

Table 5.1: A sample Table ... some numbers.

7C0	hexadecimal
3700	octal
11111000000	binary
1984	decimal

- Developed between 1969 and 1973 by Dennis Ritchie. [With help from Ken Thompson.]
- One of the most influential computer languages.

Sample numbered list:

1. Predictor: Small step in direction $\lambda \in \mathcal{N}(J_G(x))$:
2. Corrector: $y^{k+1} = y^k + (J_G(y^k))^{-1} G(y^k, \lambda)$

5.2 Section#1

Example Section.

5.2.1 Subsection #1

Example subsection.

Subsubsection #1

Because I can. [But I did not assign a color to the font.]

$$\frac{\partial u}{\partial t} = k \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right) \tag{5.1}$$

5.2.2 Code Details

Here is an example code listing:

```
#include <stdio.h>
#define N 10
/* Block
 * comment */

int main()
{
    int i;

    // Line comment.
    puts("Hello world!");

    for (i = 0; i < N; i++)
    {
        puts("LaTeX is also great for programmers!");
    }

    return 0;
```

```
}
```

This code listing is not floating or automatically numbered. If you want auto-numbering, but it in the algorithm environment (not algorithmic however) shown above.

Sample algorithm: Algorithm 1. This algorithm environment is automatically placed - meaning it floats. You don't have to worry about placement or numbering.

Algorithm 1 Calculate $y = x^n$

Require: $n \geq 0 \vee x \neq 0$
Ensure: $y = x^n$
  $y \Leftarrow 1$
  if $n < 0$ **then**
    $X \Leftarrow 1/x$
    $N \Leftarrow -n$
  else
    $X \Leftarrow x$
    $N \Leftarrow n$
  end if
  while $N \neq 0$ **do**
    if N is even **then**
      $X \Leftarrow X \times X$
      $N \Leftarrow N/2$
    else {N is odd}
      $y \Leftarrow y \times X$
      $N \Leftarrow N - 1$
    end if
  end while

Citations look like [**?**, **?**, **?**] and [**?**, **?**, **?**]. These are done automatically. Just fill in the database `designrefs.bib` using the same field structure as the other entries. Then pdflatex the document, bibtex the document and pdflatex twice again. The first pdflatex creates requests for bibliography entries. The bibtex extracts and formats the requested entries. The next pdflatex puts them in order and assigns labels. The final pdflatex replaces references in the text with the assigned labels. The bibliography is automatically constructed.

5.3 Section #2

An example of a minipage environment (gets side by side content - like two column mode). Also there is an example of a flow chart using tikz. Flowcharts

More in the sample document at the end.

A

Supporting Materials

This document will contain several appendices used as a way to separate out major component details, logic details, or tables of information. Use of this structure will help keep the document clean, readable, and organized.

B

Code

Insert code here. You can use the listing environment or use doxygen.

LaTeX Example

LaTeX sample file:

B.1 Introduction

This is a sample input file. Comparing it with the output it generates can show you how to produce a simple document of your own.

B.2 Ordinary Text

The ends of words and sentences are marked by spaces. It doesn't matter how many spaces you type; one is as good as 100. The end of a line counts as a space.

One or more blank lines denote the end of a paragraph.

Since any number of consecutive spaces are treated like a single one, the formatting of the input file makes no difference to TeX, but it makes a difference to you. When you use LaTeX, making your input file as easy to read as possible will be a great help as you write your document and when you change it. This sample file shows how you can add comments to your own input file.

Because printing is different from typewriting, there are a number of things that you have to do differently when preparing an input file than if you were just typing the document directly. Quotation marks like "this" have to be handled specially, as do quotes within quotes: " 'this' is what I just wrote, not 'that' ".

Dashes come in three sizes: an intra-word dash, a medium dash for number ranges like 1–2, and a punctuation dash—like this.

A sentence-ending space should be larger than the space between words within a sentence. You sometimes have to type special commands in conjunction with punctuation characters to get this right, as in the following sentence. Gnats, gnus, etc. all begin with G. You should check the spaces after periods when reading your output to make sure you haven't forgotten any special cases. Generating an ellipsis ... with the right spacing around the periods requires a special command.

TeX interprets some common characters as commands, so you must type special commands to generate them. These characters include the following: $ & % # { and }.

In printing, text is emphasized by using an *italic* type style.

A long segment of text can also be emphasized in this way. Text within such a segment given additional emphasis with Roman *type. Italic type loses its ability to emphasize and become simply distracting when used excessively.*

It is sometimes necessary to prevent TeX from breaking a line where it might otherwise do so. This may be at a space, as between the "Mr." and "Jones" in "Mr. Jones", or within a word—especially when the word is a symbol like *itemnum* that makes little sense when hyphenated across lines.

Footnotes[1] pose no problem.

TeX is good at typesetting mathematical formulas like $x - 3y = 7$ or $a_1 > x^{2n}/y^{2n} > x'$. Remember that a letter like x is a formula when it denotes a mathematical symbol, and should be treated as one.

[1] This is an example of a footnote.

B.3 Displayed Text

Text is displayed by indenting it from the left margin. Quotations are commonly displayed. There are short quotations

> This is a short a quotation. It consists of a single paragraph of text. There is no paragraph indentation.

and longer ones.

> This is a longer quotation. It consists of two paragraphs of text. The beginning of each paragraph is indicated by an extra indentation.
>
> This is the second paragraph of the quotation. It is just as dull as the first paragraph.

Another frequently-displayed structure is a list. The following is an example of an *itemized* list.

- This is the first item of an itemized list. Each item in the list is marked with a "tick". The document style determines what kind of tick mark is used.
- This is the second item of the list. It contains another list nested inside it. The inner list is an *enumerated* list.
  1. This is the first item of an enumerated list that is nested within the itemized list.
  2. This is the second item of the inner list. LaTeX allows you to nest lists deeper than you really should.

  This is the rest of the second item of the outer list. It is no more interesting than any other part of the item.
- This is the third item of the list.

You can even display poetry.

> There is an environment for verse
> Whose features some poets will curse.
>
> For instead of making
> Them do *all* line breaking,
> It allows them to put too many words on a line when they'd rather be forced to be terse.

Mathematical formulas may also be displayed. A displayed formula is one-line long; multi-line formulas require special formatting instructions.

$$x' + y^2 = z_i^2$$

Don't start a paragraph with a displayed equation, nor make one a paragraph by itself.

B.4 Build process

To build LaTeX documents you need the latex program. It is free and available on all operating systems. Download and install. Many of us use the TexLive distribution and are very happy with it. You can use a editor and command line or use an IDE. To build this document via command line:

```
alta>  pdflatex SystemTemplate
```

If you change the bib entries, then you need to update the bib files:

```
alta>  pdflatex SystemTemplate
alta>  bibtex SystemTemplate
alta>  pdflatex SystemTemplate
alta>  pdflatex SystemTemplate
```

The template files provided also contain a Makefile, which will make things much easier.

Acknowledgment

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