

B.Sc. in Computer Science and Engineering Thesis

Bangla License Plate Recognition

Submitted by

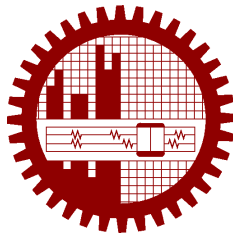
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February 2017

CANDIDATES' DECLARATION

This is to certify that the work presented in this thesis, titled, “Bangla License Plate Recognition”, is the outcome of the investigation and research carried out by us under the supervision of Supervisor Name.

It is also declared that neither this thesis nor any part thereof has been submitted anywhere else for the award of any degree, diploma or other qualifications.

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CERTIFICATION

This thesis titled, “**Bangla License Plate Recognition**”, submitted by the group as mentioned below has been accepted as satisfactory in partial fulfillment of the requirements for the degree B.Sc. in Computer Science and Engineering in February 2017.

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ABSTRACT

Write your thesis abstract here.

Chapter 1

Introduction

This chapter is for your introduction.

1.1 Cross Referencing

We have incorporated the `\cref` or `\Cref` command from `cleveref` package in this system. This will automatically insert words like Figure, Table etc. in your text.

See these examples:

- Figure 1.1 is a sample figure.
- Table 1.1 is a table.
- Section 2.1 in Chapter 2 shows some examples of citations.

1.2 How to Write a Section

This is for writing section.

1.3 How to Add Table and Figures

You should refer a figure as, “Figure 1.1 is a sample figure”.

Then we applied same test cases to our modified algorithm i.e. the heuristic algorithm with our new operation *Block Reversal*. The performance is shown in Table 1.1.

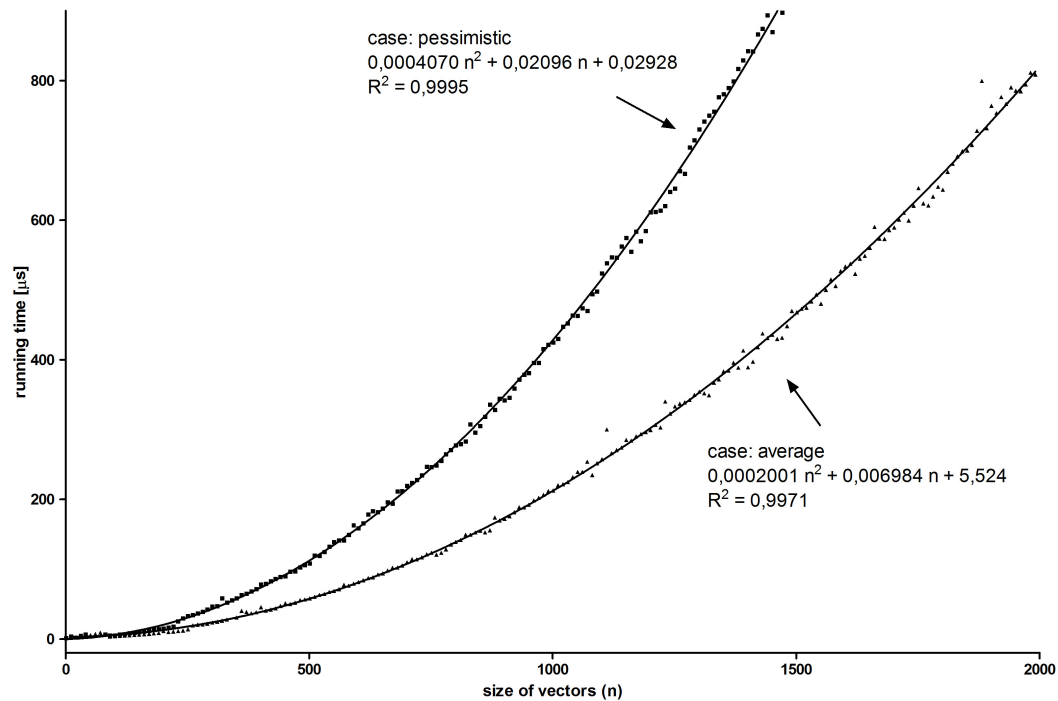


Figure 1.1: This is a sample figure.

Table 1.1: Performance table of *Block reversal* in a heuristic algorithm

α	αn	Test Cases											Average # of calculated operation
		1	2	3	4	5	6	7	8	9	10	11	
0.1	2	2	2	2	2	2	2	2	2	2	2	2	2
0.2	4	4	4	5	2	4	4	4	4	2	4	4	3.73
0.3	6	5	6	6	6	6	7	6	5	6	6	6	5.91
0.4	8	7	8	5	6	7	6	6	7	8	8	7	6.82
0.5	10	9	10	6	12	10	8	10	10	7	7	10	9
0.6	12	9	12	16	10	12	12	9	11	12	9	12	11.27
0.7	14	13	7	18	15	14	8	13	11	13	13	14	12.64
0.8	16	10	17	14	16	13	16	13	11	13	17	13	13.91
0.9	18	14	16	15	12	15	11	15	11	15	12	12	13.45
1	20	18	11	13	11	13	15	17	17	13	18	12	14.36

These are some dummy text used as page fillers only.

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Chapter 2

Citation Examples

In this chapter we show how we can cite the references.

2.1 See the Citations

As discussed by authors in [1–3] we can further show how this affects us. Moreover [4–11] can be examples for the previous works. Among these [10, 12–17] are the prominent ones. Also you can take a look at [18–25].

Chapter 3

Another Chapter

3.1 A Section

Some text.

3.1.1 This is a Subsection

And some more.

This is a Subsubsection

Yet some more.

3.2 And Another Section

Here are some dummy texts.

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Chapter 4

Index Creation

4.1 BUET

Bangladesh University of Engineering and Technology, abbreviated as BUET, is one of the most prestigious institutions for higher studies in the country. About 5500 students are pursuing undergraduate and postgraduate studies in engineering, architecture, planning and science in this institution. At present, BUET has sixteen teaching departments under five faculties and it has three institutes. Every year the intake of undergraduate students is around 900, while the intake of graduate students in Master's and PhD programs is around 1000. A total of about five hundred teachers are teaching in these departments and institutes. There are additional teaching posts like Dr. Rashid Professor, Professor Emeritus and Supernumerary Professors.

4.2 Campus

The BUET campus is in the heart of Dhaka — the capital city of Bangladesh. It has a compact campus with halls of residence within walking distances of the academic buildings. The physical expansion of the University over the last three decades has been impressive with construction of new academic buildings, auditorium complex, halls of residence, etc.

4.3 History

BUET is the oldest institution for the study of Engineering and Architecture in Bangladesh. The history of this institution dates back to the days of Dhaka Survey School which was established at Nalgola, in Old Dhaka in 1876 to train Surveyors for the then Government of Bengal of British India. As the years passed, the Survey School became the Ahsanullah School of En-

gineering offering three-year diploma courses in Civil, Electrical and Mechanical Engineering. In recognition of the generous financial contribution from the then Nawab of Dhaka, it was named after his father Khawja Ahsanullah. It moved to its present premises in 1912. In 1947, the School was upgraded to Ahsanullah Engineering College as a Faculty of Engineering under the University of Dhaka, offering four-year bachelors courses in Civil, Electrical, Mechanical, Chemical and Metallurgical Engineering. In order to create facilities for postgraduate studies and research, Ahsanullah Engineering College was upgraded to the status of a University in 1962 and was named East Pakistan University of Engineering and Technology. After the War of Liberation in 1971, Bangladesh became an independent state and the university was renamed as the Bangladesh University of Engineering and Technology.

4.4 Students

Till today, it has produced around 25,000 graduates in different branches of engineering and architecture, and has established a good reputation all over the world for the quality of its graduates, many of whom have excelled in their profession in different parts of the globe. It was able to attract students from countries like India, Nepal, Iran, Jordan, Malaysia, Sri Lanka, Pakistan and Palestine.

4.5 Departments

Both Undergraduate and Postgraduate studies and research are now among the primary functions of the University. Eleven departments under five faculties offer Bachelor Degrees, while most of the departments and institutes offer Master's Degrees and some of the departments have Ph.D. programs. In addition to its own research programs, the university undertakes research programs sponsored by outside organizations like European Union, UNO, Commonwealth, UGC, etc. The expertise of the University teachers and the laboratory facilities of the University are also utilized to solve problems and to provide up-to-date engineering and technological knowledge to the various organizations of the country.

Chapter 5

k -safe Labeling of Petersen Graph

In 1898, Petersen produced a trivalent graph with no leaves, now called the Petersen graph [\[26\]](#). In this chapter we study k -safe labeling for the Petersen graph. We also give upper bound for the span of the Petersen graph. We provide necessary proof for the upper bound.

References

- [1] M. M. Akbar, M. S. Rahman, M. Kaykobad, E. G. Manning, and G. C. Shoja, “Solving the multidimensional multiple-choice knapsack problem by constructing convex hulls,” *Computers & operations research*, vol. 33, no. 5, pp. 1259–1273, 2006.
- [2] R. Karim, M. M. Al Aziz, S. Shatabda, M. S. Rahman, M. A. K. Mia, F. Zaman, and S. Rakin, “CoMOGrad and PHOG: From computer vision to fast and accurate protein tertiary structure retrieval,” *Scientific reports*, vol. 5, 2015.
- [3] M. S. Alam, M. M. Islam, X. Yao, and K. Murase, “Diversity guided evolutionary programming: A novel approach for continuous optimization,” *Applied soft computing*, vol. 12, no. 6, pp. 1693–1707, 2012.
- [4] M. Kaykobad, “On nonnegative factorization of matrices,” *Linear Algebra and its applications*, vol. 96, pp. 27–33, 1987.
- [5] M. Kaykobad, “Positive solutions of positive linear systems,” *Linear algebra and its applications*, vol. 64, pp. 133–140, 1985.
- [6] M. Kaykobad, M. M. Islam, M. E. Amyeen, and M. M. Murshed, “3 is a more promising algorithmic parameter than 2,” *Computers & Mathematics with Applications*, vol. 36, no. 6, pp. 19–24, 1998.
- [7] “The MCNC benchmark problems for VLSI floorplanning.” Last accessed on July 21, 2014, at 02:08:00PM. [Online]. Available: <https://www.mcnc.org/>.
- [8] P.-N. Guo, T. Takahashi, C.-K. Cheng, and T. Yoshimura, “Floorplanning using a tree representation,” *Computer-Aided Design of Integrated Circuits and Systems, IEEE Transactions on*, vol. 20, no. 2, pp. 281–289, 2001.
- [9] J. Holland, *Adaptation in Natural and Artificial Systems*. University of Michigan Press, 1975.
- [10] U. Aickelin and D. Dasgupta, “Artificial immune systems,” in *Search Methodologies*, pp. 375–399, Springer, 2005.

- [11] J. R. Al-Enezi, M. F. Abbod, and S. A. Sharhan, "Artificial immune systems-models, algorithms and applications," *International Journal*, vol. 3, no. 2, 2010.
- [12] S. A. Faruque, M. A. Khatun, and M. S. Rahman, "Modelling direct marketing campaign on social networks," *International Journal of Business Information Systems*, vol. 22, no. 4, pp. 422–435, 2016.
- [13] S. Durocher, D. Mondal, and M. S. Rahman, "On graphs that are not PCGs," *Theoretical Computer Science*, vol. 571, pp. 78–87, 2015.
- [14] M. S. Rahman, A. Alatabbi, T. Athar, M. Crochemore, and M. S. Rahman, "Absent words and the (dis) similarity analysis of DNA sequences: an experimental study," *BMC research notes*, vol. 9, no. 1, p. 1, 2016.
- [15] T. Hashem, L. Kulik, and R. Zhang, "Countering overlapping rectangle privacy attack for moving kNN queries," *Information Systems*, vol. 38, no. 3, pp. 430–453, 2013.
- [16] S. M. Farhad, M. A. Nayeem, M. K. Rahman, and M. S. Rahman, "Mapping stream programs onto multicore platforms by local search and genetic algorithm," *Computer Languages, Systems & Structures*, vol. 46, pp. 182–205, 2016.
- [17] S. M. B. Malek, M. M. Sadik, and A. K. M. Rahman, "On balanced k -coverage in visual sensor networks," *Journal of Network and Computer Applications*, vol. 72, pp. 72–86, 2016.
- [18] G. M. M. Bashir, A. S. M. L. Hoque, and B. C. D. Nath, "E-learning of PHP based on the solutions of real-life problems," *Journal of Computers in Education*, vol. 3, no. 1, pp. 105–129, 2016.
- [19] M. Y. S. Uddin and R. Rafiq, "Citizen assisted environmental pollution measurement in developing cities," *International Journal of Environmental Science and Development*, vol. 5, no. 1, p. 70, 2014.
- [20] A. Kamal and M. M. Islam, "Boosting up the data hiding rate through multi cycle embedding process," *Journal of Visual Communication and Image Representation*, vol. 40, pp. 574–588, 2016.
- [21] M. E. Haque and A. K. M. Rahman, "On constructing interference-aware k -fault resistant topologies for wireless ad hoc networks," *Ad Hoc & Sensor Wireless Networks*, vol. 19, no. 1-2, pp. 67–94, 2013.
- [22] M. S. H. Mukta, M. E. Ali, and J. Mahmud, "Identifying and validating personality traits-based homophilies for an egocentric network," *Social Network Analysis and Mining*, vol. 6, no. 1, p. 74, 2016.

- [23] M. E. Ali, E. Tanin, P. Scheuermann, S. Nutanong, and L. Kulik, “Spatial consensus queries in a collaborative environment,” *ACM Transactions on Spatial Algorithms and Systems*, vol. 2, no. 1, p. 3, 2016.
- [24] M. M. Islam, M. A. Sattar, M. F. Amin, X. Yao, and K. Murase, “A new constructive algorithm for architectural and functional adaptation of artificial neural networks,” *IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics)*, vol. 39, no. 6, pp. 1590–1605, 2009.
- [25] A. A. Al Islam, C. S. Hyder, H. Kabir, M. Naznin, *et al.*, “Stable sensor network (ssn): a dynamic clustering technique for maximizing stability in wireless sensor networks,” *Wireless sensor network*, vol. 2, no. 07, p. 538, 2010.
- [26] D. A. Holton and J. Sheehan, *The Petersen Graph*, vol. 7. Cambridge University Press, 1993.

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Appendix A

Algorithms

A.1 Sample Algorithm

In Algorithm 1 we show how to calculate $y = x^n$.

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

Appendix B

Codes

B.1 Sample Code

We use this code to find out...

```
1 #include <stdio.h>
2 int Fibonacci(int);
3
4 main()
5 {
6     int n, i = 0, c;
7
8     printf("Enter_the_value_of_n:_");
9     scanf("%d",&n);
10
11     printf("\nFibonacci_series\n");
12
13     for (c = 1 ; c <= n ; c++)
14     {
15         printf("%d\n", Fibonacci(i));
16         i++;
17     }
18
19     return 0;
20 }
21
22 int Fibonacci(int n)
23 {
```

```
24  if (n == 0)
25      return 0;
26  else if (n == 1)
27      return 1;
28  else
29      return (Fibonacci(n-1) + Fibonacci(n-2));
30 }
```

B.2 Another Sample Code

```
1 SELECT associations2.object_id, associations2.term_id,
2      associations2.cat_ID, associations2.term_taxonomy_id
3 FROM (SELECT objects_tags.object_id, objects_tags.term_id,
4      wp_cb_tags2cats.cat_ID, categories.term_taxonomy_id
5 FROM (SELECT wp_term_relationships.object_id,
6      wp_term_taxonomy.term_id, wp_term_taxonomy.term_taxonomy_id
7 FROM wp_term_relationships
8 LEFT JOIN wp_term_taxonomy ON
9      wp_term_relationships.term_taxonomy_id =
10     wp_term_taxonomy.term_taxonomy_id
11 ORDER BY object_id ASC, term_id ASC)
12 AS objects_tags
13 LEFT JOIN wp_cb_tags2cats ON objects_tags.term_id =
14     wp_cb_tags2cats.tag_ID
15 LEFT JOIN (SELECT wp_term_relationships.object_id,
16     wp_term_taxonomy.term_id as cat_ID,
17     wp_term_taxonomy.term_taxonomy_id
18 FROM wp_term_relationships
19 LEFT JOIN wp_term_taxonomy ON
20     wp_term_relationships.term_taxonomy_id =
21     wp_term_taxonomy.term_taxonomy_id
22 WHERE wp_term_taxonomy.taxonomy = 'category'
23 GROUP BY object_id, cat_ID, term_taxonomy_id
24 ORDER BY object_id, cat_ID, term_taxonomy_id)
25 AS categories on wp_cb_tags2cats.cat_ID = categories.term_id
26 WHERE objects_tags.term_id = wp_cb_tags2cats.tag_ID
27 GROUP BY object_id, term_id, cat_ID, term_taxonomy_id
28 ORDER BY object_id ASC, term_id ASC, cat_ID ASC)
29 AS associations2
30 LEFT JOIN categories ON associations2.object_id =
```

```
31         categories.object_id
32 WHERE associations2.cat_ID <> categories.cat_ID
33 GROUP BY object_id, term_id, cat_ID, term_taxonomy_id
34 ORDER BY object_id, term_id, cat_ID, term_taxonomy_id
```

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