Republic of the Philippines
Tarlac State University
COLLEGE OF COMPUTER STUDIES
Tarlac City, Tarlac
Tel. No. (045) 6068173

A case study

In partial fulfillment of the requirements

for the course Operating Systems

Implementation of the Page Replacement Algorithms

(FIFO, LRU and Optimal Algorithm)

https://github.com/its-xin/PageReplacementAlgorithm

Submitted by:

Mendoza, Kim Georgia S.

BSCS-3B

Submitted to: Ma'am Jo Anne G. Cura

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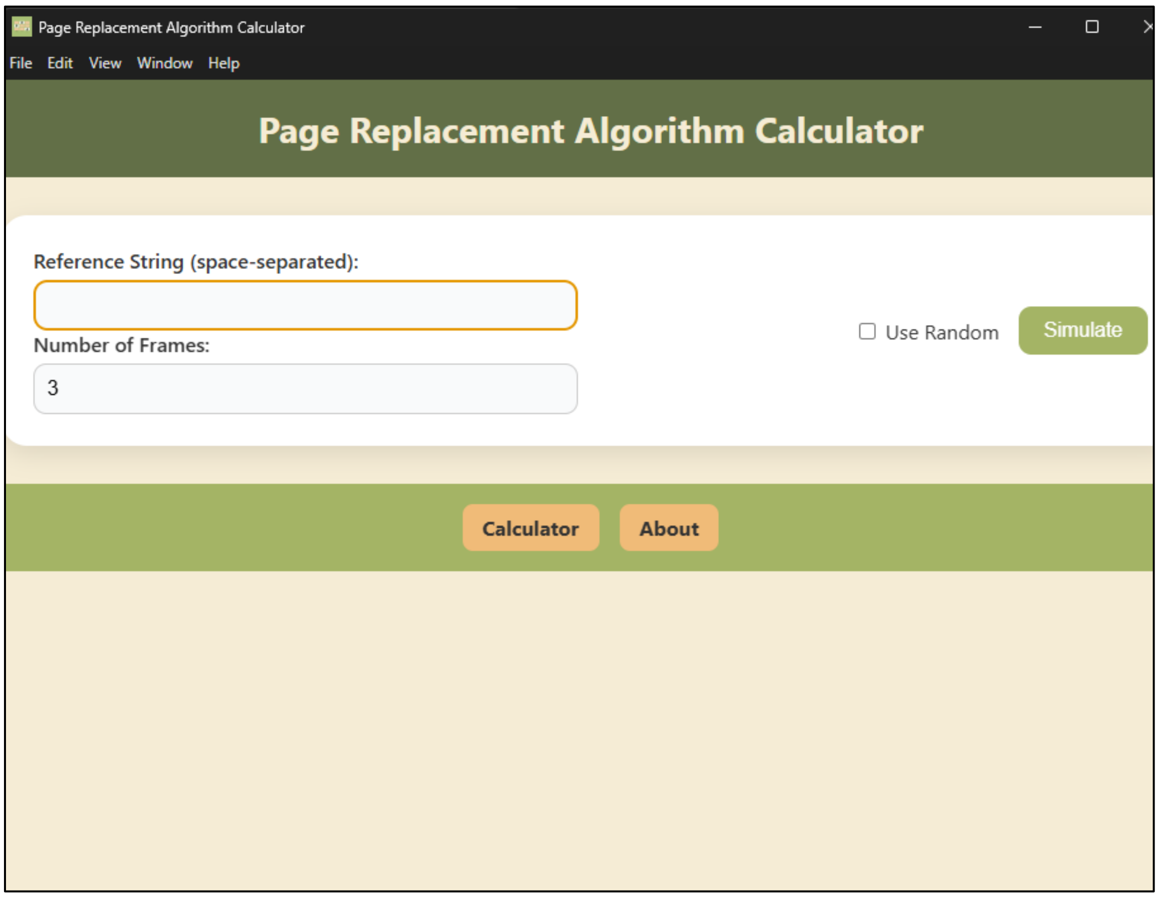
Page Replacement Algorithm Calculator
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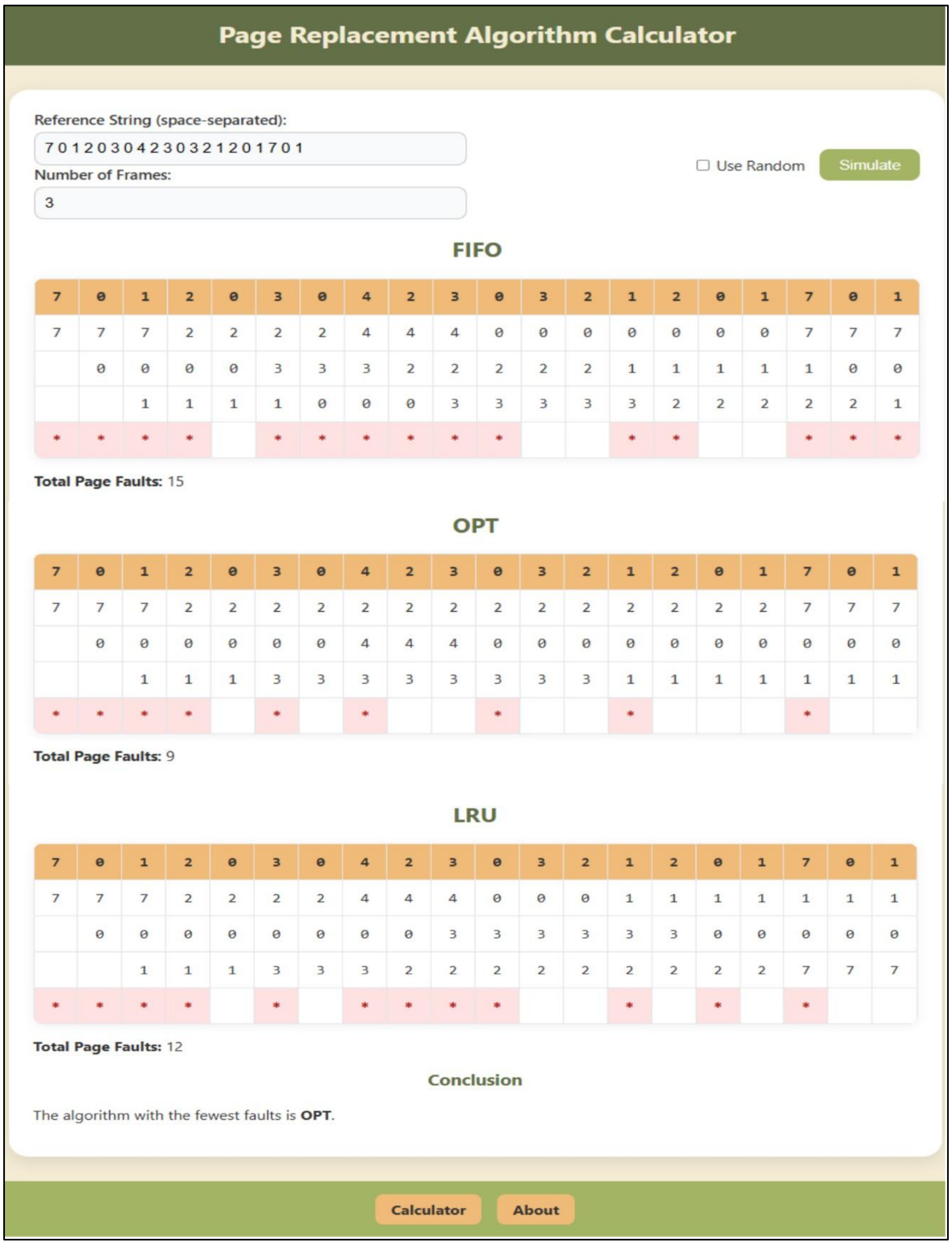
Figure 1. Main Interface

The Main Interface is the starting point of the Page Replacement Algorithm Calculator. It features an easy-to-use form where users can input a custom reference string (separated by spaces) and specify the number of available frames. A checkbox labeled "Use Random" allows users to generate a randomized reference string for quicker testing or exploration. Once the necessary values are entered, clicking the Simulate button triggers the page replacement algorithm chosen by the user. The clean layout, visually organized fields, and accessible design make it suitable for both beginners and students learning operating system concepts.

2. Simulation Result Panel

Reference String: 7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1

Number of Page Frames: 3



Page Replacement Algorithm Calculator

Reference String (space-separated):
7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1

Number of Frames:
3

☐ Use Random Simulate

FIFO

7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
7	7	7	2	2	2	2	4	4	4	0	0	0	0	0	0	0	7	7	7
	0	0	0	0	3	3	3	2	2	2	2	2	1	1	1	1	1	0	0
		1	1	1	1	0	0	0	3	3	3	3	3	2	2	2	2	2	1
*	*	*	*		*	*	*	*	*	*			*	*			*	*	*

Total Page Faults: 15

OPT

7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
7	7	7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	7	7	7
	0	0	0	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0
		1	1	1	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1
*	*	*	*		*		*			*			*				*		

Total Page Faults: 9

LRU

7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
7	7	7	2	2	2	2	4	4	4	0	0	0	1	1	1	1	1	1	1
	0	0	0	0	0	0	0	0	3	3	3	3	3	3	0	0	0	0	0
		1	1	1	3	3	3	2	2	2	2	2	2	2	2	2	7	7	7
*	*	*	*		*		*	*	*	*			*		*		*		

Total Page Faults: 12

Conclusion

The algorithm with the fewest faults is **OPT**.

Figure 2. Simulation Result Panel

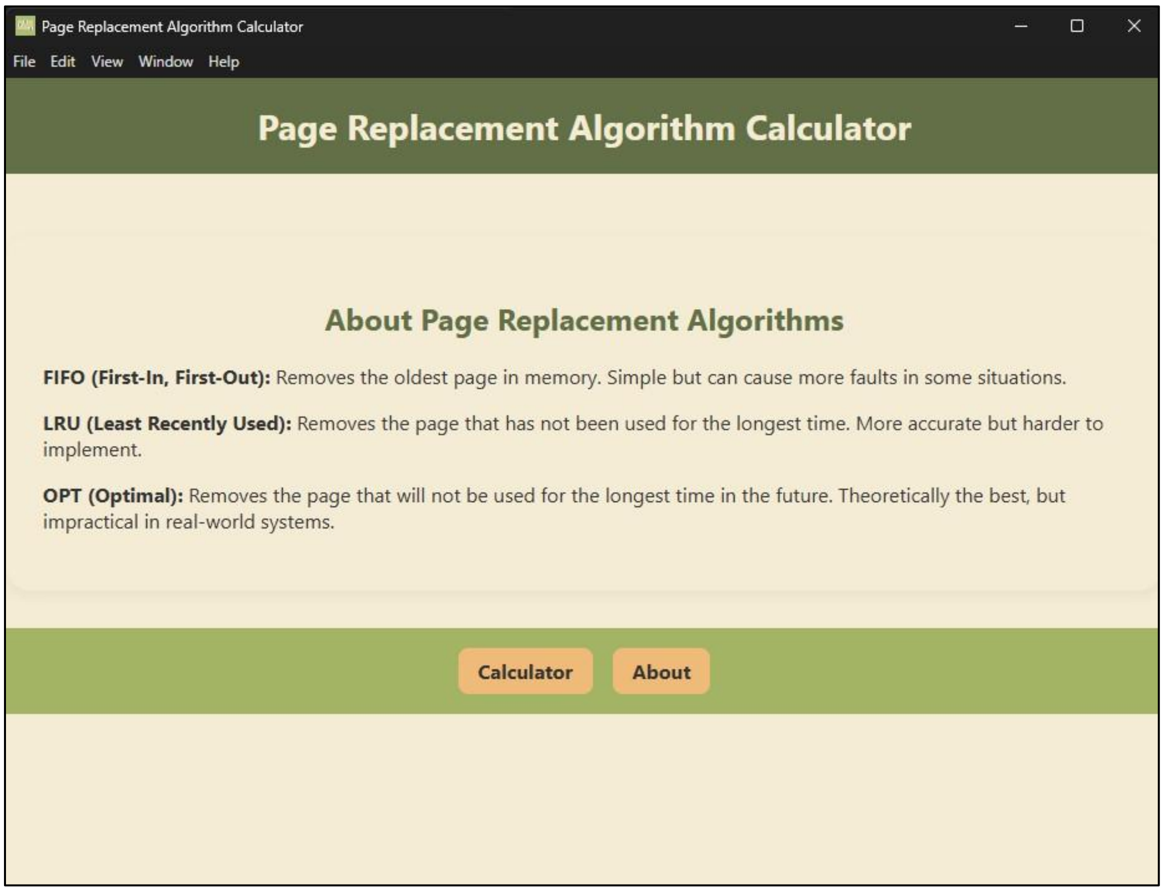
After running a simulation, the Simulation Result Panel displays a visual representation of how the page replacement algorithm processes the reference string. This result is presented in a grid format, showing memory frames across each time step. It indicates which pages are loaded, when a page fault occurs, and how pages are replaced based on the selected algorithm—FIFO (First-In, First-Out), LRU (Least Recently Used), or OPT (Optimal). The clear and step-by-step visualization helps learners grasp the internal workings of memory management in operating systems, making it a valuable educational tool.

Algorithm	**Page Faults**
First-In-First-Out (FIFO)	15
Optimal (OPT)	9
Least Recently Used (LRU)	12

Table 1: Simulation Results

The simulation results show that the Optimal (OPT) algorithm performed the best with only 9 page faults, as it selects the page that will not be used for the longest time. Least Recently Used (LRU) followed with 12 page faults, offering a good practical alternative by replacing the page that hasn't been used recently. First-In-First-Out (FIFO) had the highest number of page faults at 15, showing its weakness in not considering page usage patterns. Overall, while OPT is ideal in theory, LRU provides a more realistic and efficient option compared to FIFO for most real-world scenarios.

3. About Panel


Page Replacement Algorithm Calculator
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Page Replacement Algorithm Calculator

About Page Replacement Algorithms

FIFO (First-In, First-Out): Removes the oldest page in memory. Simple but can cause more faults in some situations.

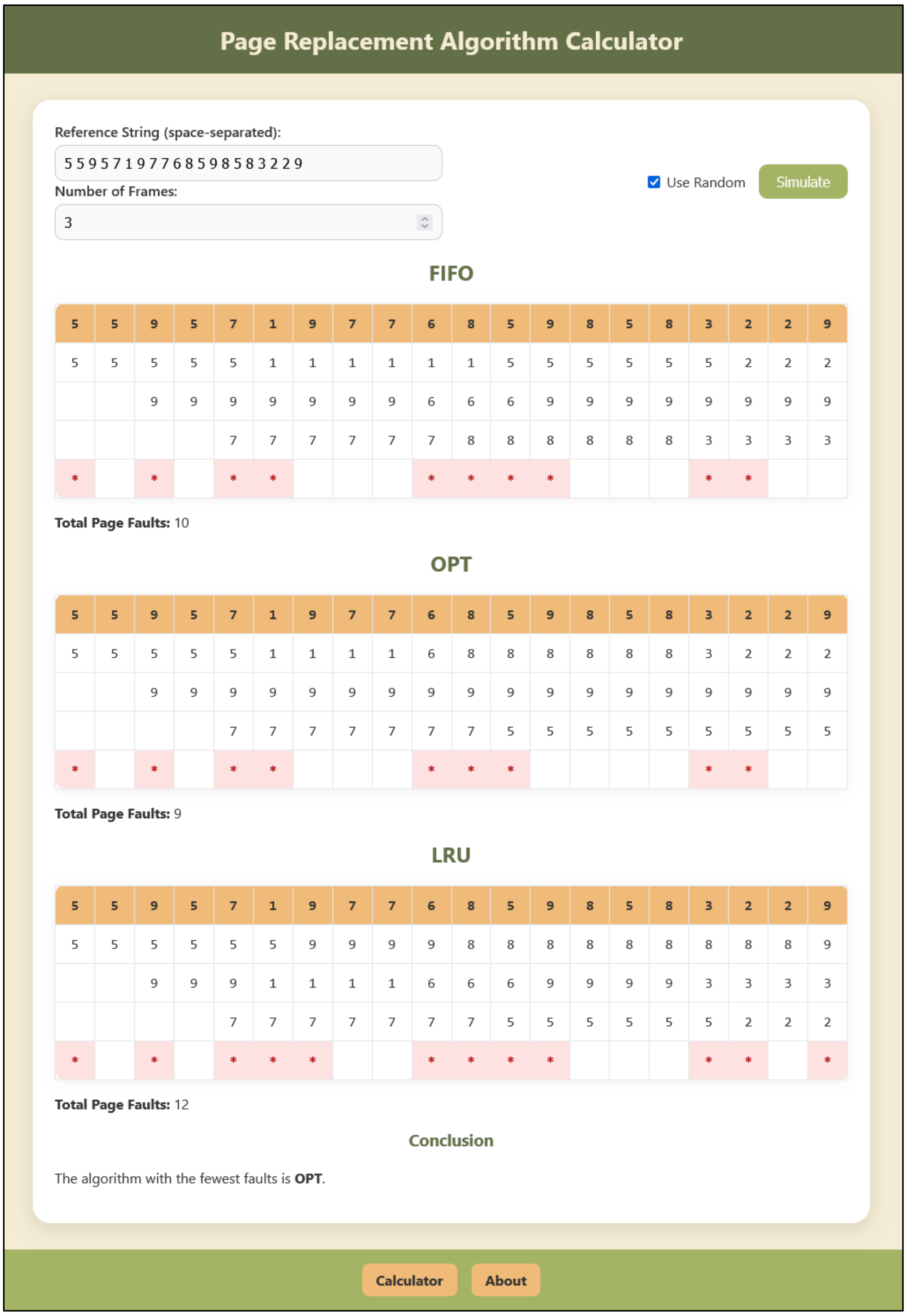
LRU (Least Recently Used): Removes the page that has not been used for the longest time. More accurate but harder to implement.

OPT (Optimal): Removes the page that will not be used for the longest time in the future. Theoretically the best, but impractical in real-world systems.

Figure 3. About Panel

The About Panel gives a clear and simple overview of the three page replacement algorithms that the application supports: FIFO, LRU, and OPT. It explains how each algorithm works and what it means in everyday terms. FIFO, which stands for First-In, First-Out, removes the oldest page in memory. It is easy to use but can lead to more errors in some situations. LRU, or Least Recently Used, gets rid of the page that hasn’t been accessed for the longest time. This method is usually more effective but is harder to implement. OPT, or Optimal, tries to achieve the best results by removing the page that won’t be used for the longest time in the future. While this approach sounds great in theory, it is not practical for real-life systems. This page serves as a helpful reference for users who want to better understand how each algorithm behaves and why they matter in operating systems.

Sample Outputs



Page Replacement Algorithm Calculator

Reference String (space-separated):
5 5 9 5 7 1 9 7 7 6 8 5 9 8 5 8 3 2 2 9

Number of Frames:
3

☑ Use Random

FIFO

5	5	9	5	7	1	9	7	7	6	8	5	9	8	5	8	3	2	2	9
5	5	5	5	5	1	1	1	1	1	1	5	5	5	5	5	5	2	2	2
		9	9	9	9	9	9	9	6	6	6	9	9	9	9	9	9	9	9
				7	7	7	7	7	7	8	8	8	8	8	8	3	3	3	3
*		*		*	*				*	*	*	*				*	*		

Total Page Faults: 10

OPT

5	5	9	5	7	1	9	7	7	6	8	5	9	8	5	8	3	2	2	9
5	5	5	5	5	1	1	1	1	6	8	8	8	8	8	8	3	2	2	2
		9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
				7	7	7	7	7	7	7	5	5	5	5	5	5	5	5	5
*		*		*	*				*	*	*					*	*		

Total Page Faults: 9

LRU

5	5	9	5	7	1	9	7	7	6	8	5	9	8	5	8	3	2	2	9
5	5	5	5	5	5	9	9	9	9	8	8	8	8	8	8	8	8	8	9
		9	9	9	1	1	1	1	6	6	6	9	9	9	9	3	3	3	3
				7	7	7	7	7	7	7	5	5	5	5	5	5	2	2	2
*		*		*	*	*			*	*	*	*				*	*		*

Total Page Faults: 12

Conclusion

The algorithm with the fewest faults is **OPT**.

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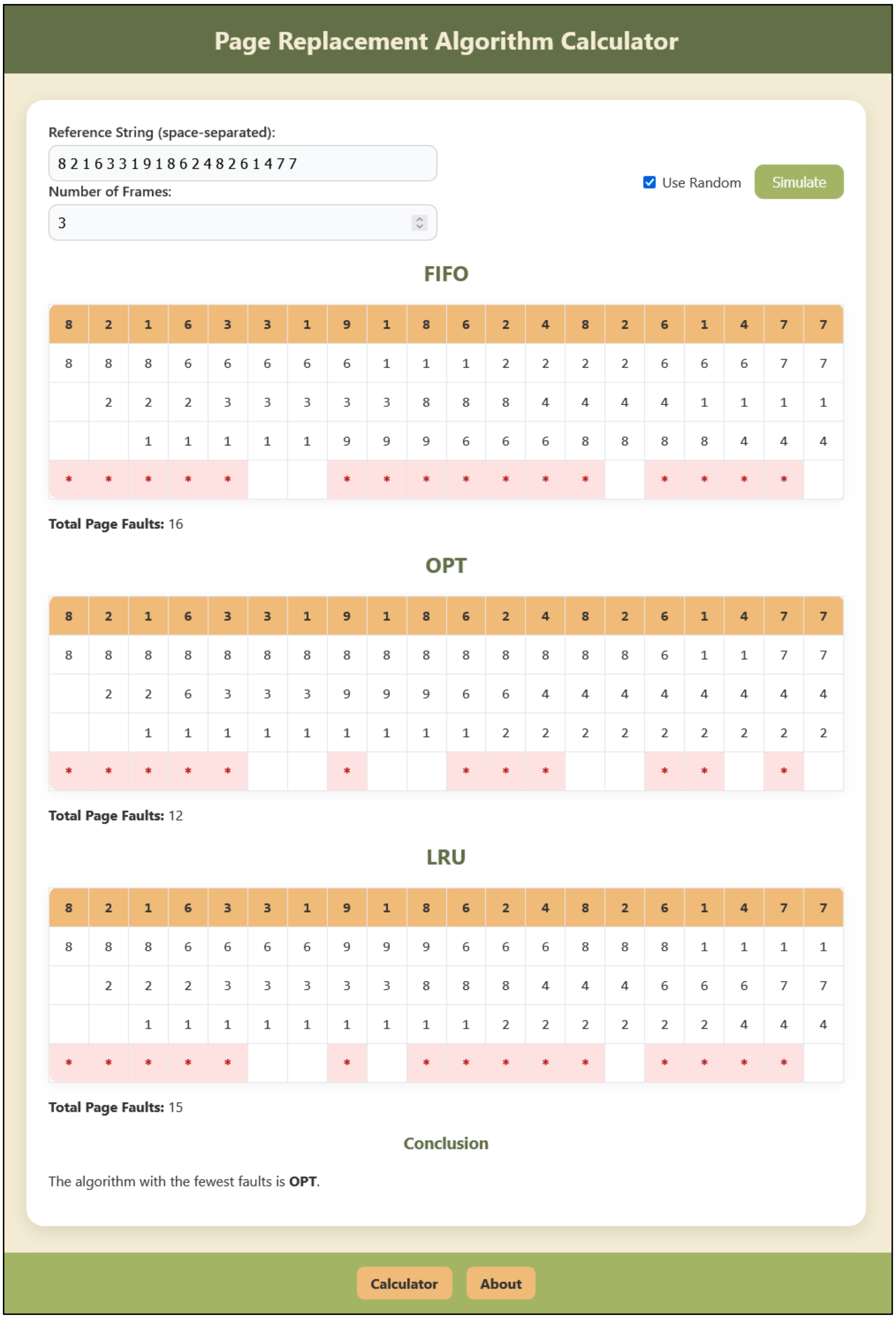

Page Replacement Algorithm Calculator

Reference String (space-separated): 8 2 1 6 3 3 1 9 1 8 6 2 4 8 2 6 1 4 7 7

Number of Frames: 3

☑ Use Random

FIFO

8	2	1	6	3	3	1	9	1	8	6	2	4	8	2	6	1	4	7	7
8	8	8	6	6	6	6	6	1	1	1	2	2	2	2	6	6	6	7	7
	2	2	2	3	3	3	3	3	8	8	8	4	4	4	4	1	1	1	1
		1	1	1	1	1	9	9	9	6	6	6	8	8	8	8	4	4	4
*	*	*	*	*			*	*	*	*	*	*	*		*	*	*	*	

Total Page Faults: 16

OPT

8	2	1	6	3	3	1	9	1	8	6	2	4	8	2	6	1	4	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	6	1	1	7	7
	2	2	6	3	3	3	9	9	9	6	6	4	4	4	4	4	4	4	4
		1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
*	*	*	*	*			*			*	*	*			*	*		*	

Total Page Faults: 12

LRU

8	2	1	6	3	3	1	9	1	8	6	2	4	8	2	6	1	4	7	7
8	8	8	6	6	6	6	9	9	9	6	6	6	8	8	8	1	1	1	1
	2	2	2	3	3	3	3	3	8	8	8	4	4	4	6	6	6	7	7
		1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	4	4	4
*	*	*	*	*			*		*	*	*	*	*		*	*	*	*	

Total Page Faults: 15

Conclusion

The algorithm with the fewest faults is **OPT**.