

# Basile Relatório Max-Heapfy

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Repositório Git: [https://github.com/habdig7oficial/max\\_heapfy.git](https://github.com/habdig7oficial/max_heapfy.git)

## Código Heapsort Completo

```
#include "stdio.h"
#include "math.h"
#include "stdbool.h"

void print_vec(int *vec, int len){
    printf("[");
    for (int i = 0; i < len; i++){
        printf("%d, ", vec[i]);
    }
    printf("]\n");
}

void swap(int *a, int *b){
    int aux = *a;
    *a = *b;
    *b = aux;
}

bool max_heapfy(int *vec, int i, int len){
    bool parity = (i % 2) == 0;
    int index_father = (int)i / 2 + (parity? -1 : 0);
    int index_brother = i + (parity ? -1 : 1);
    printf("Root: vec[%d] = %d\n", index_father, vec[index_father]);
    printf("Leaf: vec[%d] = %d\n", i, vec[i]);
    printf("Brother: vec[%d] = %d\n", index_brother, vec[index_brother]);
    printf("\n");

    if(index_brother >= len){
        return false;
    }
}
```

```

}

int max_child = (vec[i] >= vec[index_brother])? i : index_brother;
if(vec[max_child] > vec[index_father]){
    swap(&vec[index_father], &vec[max_child]);

    printf("Troca: %d %d\n", vec[max_child], vec[index_father]);
    return true;
}

print_vec(vec, len);
return false;
}

int main(){
    int vec[] = {2, 14, 6, 8, 5, 4, 3, 1, 7, 9, 6, 10, 17, 20, 12, 19};
    int len = sizeof(vec) / sizeof(int);
    print_vec(vec, len);

    for(int i = len - 1; i > 0; i -= 2){
        max_heapfy(vec, i, len);
    }

    printf("\n-----End max Heapfy-----\n");

    print_vec(vec, len);

    for(int i = len - 1; i > 0; i--){
        swap(&vec[0], &vec[i]);
        for(int j = 1; max_heapfy(vec, j, i); j += 2){
            print_vec(vec, len);
        }
    }

    print_vec(vec, len);
}

```

Print de Execução

Max-Heapfy

```

Terminal Shell Bearbeiten Darstellung Fenster Hilfe
max_heapfy -- zsh - 214x56
~/Downloads/projetos -- zsh
~/Downloads/projetos/max_heapfy -- zsh
max_heapfy % ./heap
[2, 14, 2, 8, 9, 17, 6, 1, 7, 5, 6, 10, 4, 3, 12, 19, ]
Root: vec[7] = 1
Leaf: vec[15] = 19
Brother: vec[16] = 267059435

Root: vec[6] = 3
Leaf: vec[13] = 28
Brother: vec[14] = 12

Traces: 3 28
Root: vec[5] = 4
Leaf: vec[11] = 18
Brother: vec[12] = 17

Traces: 4 17
Root: vec[4] = 5
Leaf: vec[9] = 9
Brother: vec[10] = 6

Traces: 5 9
Root: vec[3] = 8
Leaf: vec[7] = 1
Brother: vec[8] = 7

[2, 14, 6, 8, 9, 17, 20, 1, 7, 5, 6, 10, 4, 3, 12, 19, ]
Root: vec[2] = 6
Leaf: vec[5] = 17
Brother: vec[6] = 20

Traces: 6 28
Root: vec[1] = 14
Leaf: vec[3] = 8
Brother: vec[4] = 9

[2, 14, 20, 8, 9, 17, 6, 1, 7, 5, 6, 10, 4, 3, 12, 19, ]
Root: vec[0] = 2
Leaf: vec[1] = 14
Brother: vec[2] = 20

Traces: 2 28
____End max Heapfy_____
[20, 14, 2, 8, 9, 17, 6, 1, 7, 5, 6, 10, 4, 3, 12, 19, ]
Root: vec[0] = 14
Leaf: vec[1] = 14
Brother: vec[2] = 2

[10, 14, 2, 8, 9, 17, 6, 1, 7, 5, 6, 10, 4, 3, 12, ]
Root: vec[0] = 12
Leaf: vec[1] = 14
Brother: vec[2] = 2

Traces: 12 14
[14, 12, 2, 8, 9, 17, 6, 1, 7, 5, 6, 10, 4, 3, 19, 20, ]
Root: vec[1] = 12

```

Figure 1: Max-Heapfy

# Heap Sort

```

Terminal Shell Bearbeiten Darstellung Fenster Hilfe
max_heapfy -- zsh - 214x56
~/Downloads/projetos -- zsh
-----[end max Heapfy]-----
[20, 14, 2, 8, 9, 17, 6, 1, 7, 5, 6, 10, 4, 3, 12, 19, ]
Root: vec[0] = 14
Leaf: vec[1] = 14
Brother: vec[2] = 2

[19, 14, 2, 8, 9, 17, 6, 1, 7, 5, 6, 10, 4, 3, 12, ]
Root: vec[0] = 12
Leaf: vec[1] = 14
Brother: vec[2] = 2

Troca: 12 14
[14, 12, 2, 8, 9, 17, 6, 1, 7, 5, 6, 10, 4, 3, 19, 20, ]
Root: vec[1] = 12
Leaf: vec[3] = 8
Brother: vec[4] = 9

[14, 12, 2, 8, 9, 17, 6, 1, 7, 5, 6, 10, 4, 3, ]
Root: vec[0] = 3
Leaf: vec[1] = 12
Brother: vec[2] = 2

Troca: 3 12
[12, 3, 2, 8, 9, 17, 6, 1, 7, 5, 6, 10, 4, 14, 19, 20, ]
Root: vec[1] = 3
Leaf: vec[3] = 8
Brother: vec[4] = 9

Troca: 3 9
[12, 9, 2, 8, 3, 17, 6, 1, 7, 5, 6, 10, 4, 14, 19, 20, ]
Root: vec[2] = 2
Leaf: vec[5] = 17
Brother: vec[6] = 6

Troca: 2 17
[12, 9, 17, 8, 3, 2, 6, 1, 7, 5, 6, 10, 4, 14, 19, 20, ]
Root: vec[3] = 8
Leaf: vec[7] = 1
Brother: vec[8] = 7

[12, 9, 17, 8, 3, 2, 6, 1, 7, 5, 6, 10, 4, ]
Root: vec[0] = 4
Leaf: vec[1] = 9
Brother: vec[2] = 17

Troca: 4 17
[17, 9, 4, 8, 3, 2, 6, 1, 7, 5, 6, 10, 12, 14, 19, 20, ]
Root: vec[1] = 9
Leaf: vec[3] = 17
Brother: vec[4] = 3

[17, 9, 4, 8, 3, 2, 6, 1, 7, 5, 6, 10, ]
Root: vec[0] = 18
Leaf: vec[1] = 3
Brother: vec[2] = 4

```

Figure 2: Heap Sort, 1<sup>a</sup> Página

```

Apple Terminal Shell Bearbeiten Darstellung Fenster Hilfe
~/Downloads/projetos -- zsh
max_heapfy -- zsh - 214x56
Brother: vec[2] = 4
[18, 9, 4, 8, 3, 2, 6, 1, 7, 5, 6, ]
Root: vec[0] = 6
Leaf: vec[1] = 9
Brother: vec[2] = 4
Trocas: 4 9
[9, 6, 4, 8, 3, 2, 6, 1, 7, 5, 10, 17, 12, 14, 19, 20, ]
Root: vec[1] = 6
Leaf: vec[3] = 8
Brother: vec[4] = 3
Brother: vec[6] = 4
Trocas: 6 8
[9, 8, 4, 6, 3, 2, 6, 1, 7, 5, 10, 17, 12, 14, 19, 20, ]
Root: vec[0] = 6
Leaf: vec[1] = 4
Brother: vec[2] = 2
Brother: vec[4] = 6
Brother: vec[6] = 7
Trocas: 4 6
[9, 8, 6, 6, 3, 2, 4, 1, 7, 5, 10, 17, 12, 14, 19, 20, ]
Root: vec[3] = 6
Leaf: vec[7] = 1
Brother: vec[8] = 7
Trocas: 6 7
[9, 8, 6, 7, 3, 2, 4, 1, 6, 5, 10, 17, 12, 14, 19, 20, ]
Root: vec[4] = 3
Leaf: vec[9] = 5
Brother: vec[10] = 10
Root: vec[0] = 5
Leaf: vec[1] = 8
Brother: vec[2] = 6
Trocas: 5 8
[8, 5, 6, 7, 3, 2, 4, 1, 6, 5, 10, 17, 12, 14, 19, 20, ]
Root: vec[1] = 5
Leaf: vec[3] = 7
Brother: vec[4] = 3
Brother: vec[6] = 4
Trocas: 5 7
[8, 7, 6, 5, 3, 2, 4, 1, 6, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[0] = 5
Leaf: vec[1] = 6
Brother: vec[2] = 2
Brother: vec[4] = 6
Brother: vec[6] = 7
Trocas: 6 7
[7, 6, 6, 5, 3, 2, 4, 1, 8, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[1] = 6
Leaf: vec[3] = 5

```

Figure 3: Heap Sort, 2<sup>a</sup> Página

```

Terminal Shell Bearbeiten Darstellung Fenster Hilfe
max_heapfy -- zsh - 214x56
~/Downloads/projetos -- zsh
~/Downloads/projetos/max_heapfy -- zsh + Mo. 20. Okt. 14:20

Trocas: 6 7
[7, 6, 6, 5, 3, 2, 4, 1, 8, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[1] = 6
Leaf: vec[3] = 5
Brother: vec[4] = 3

[7, 6, 6, 5, 3, 2, 4, 1, ]
Root: vec[0] = 1
Leaf: vec[1] = 6
Brother: vec[2] = 6

Trocas: 1 6
[6, 1, 6, 5, 3, 2, 4, 7, 8, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[1] = 1
Leaf: vec[3] = 5
Brother: vec[4] = 3

Trocas: 1 5
[6, 5, 6, 2, 3, 2, 4, 7, 8, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[1] = 5
Root: vec[2] = 6
Leaf: vec[5] = 2
Brother: vec[6] = 4

[6, 5, 6, 1, 3, 2, 4, ]
Root: vec[0] = 4
Leaf: vec[1] = 5
Brother: vec[2] = 6

Trocas: 4 6
[6, 5, 4, 1, 3, 2, 6, 7, 8, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[1] = 5
Root: vec[2] = 6
Leaf: vec[5] = 2
Brother: vec[6] = 4

[6, 5, 4, 1, 3, 2, ]
Root: vec[0] = 2
Leaf: vec[1] = 5
Brother: vec[2] = 4

Trocas: 2 5
[5, 2, 4, 1, 3, 6, 6, 7, 8, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[1] = 2
Root: vec[2] = 3
Leaf: vec[5] = 6
Brother: vec[6] = 6

Root: vec[0] = 2
Leaf: vec[1] = 3
Brother: vec[2] = 4

```

The screenshot shows a macOS desktop environment. In the foreground, a terminal window titled "max\_heapfy -- zsh" is open, displaying the execution of a heap sort algorithm. The terminal output shows the array being sorted through multiple stages of bubble sort-like operations, with each stage labeled by "Trocas" (Swaps) and the current state of the array. The array starts at [7, 6, 6, 5, 3, 2, 4, 1, 8, 9, 10, 17, 12, 14, 19, 20, ] and ends at [5, 2, 4, 1, 3, 6, 6, 7, 8, 9, 10, 17, 12, 14, 19, 20, ]. The terminal window has tabs for "~/Downloads/projetos" and "~/Downloads/projetos/max\_heapfy". The background shows a blurred application window with a toolbar containing various icons.

Figure 4: Heap Sort, 3<sup>a</sup> Página

```

Terminal Shell Bearbeiten Darstellung Fenster Hilfe
~/Downloads/projetos -- zsh
max_heapfy -- zsh - 214x56
Leaf: vec[1] = 5
Brother: vec[2] = 6
Trocas: 4 6
[6, 5, 4, 1, 3, 2, 6, 7, 8, 9, 10, 17, 12, 14, 19, 20, 1
Root: vec[1] = 5
Leaf: vec[1] = 5
Brother: vec[1] = 3
[6, 5, 4, 1, 3, 2, ]
Root: vec[0] = 2
Leaf: vec[1] = 5
Brother: vec[2] = 4
Trocas: 2 5
[5, 3, 4, 1, 2, 6, 6, 7, 8, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[2] = 4
Leaf: vec[3] = 1
Brother: vec[4] = 3
Trocas: 2 3
[5, 3, 4, 1, 2, 6, 6, 7, 8, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[2] = 4
Leaf: vec[5] = 6
Brother: vec[6] = 6
Root: vec[0] = 2
Leaf: vec[1] = 3
Brother: vec[2] = 4
Trocas: 2 4
[4, 3, 2, 1, 5, 6, 6, 7, 8, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[1] = 3
Leaf: vec[3] = 1
Brother: vec[4] = 5
Root: vec[0] = 1
Leaf: vec[1] = 3
Brother: vec[2] = 2
Trocas: 1 3
[3, 1, 2, 4, 5, 6, 6, 7, 8, 9, 10, 17, 12, 14, 19, 20, ]
Root: vec[1] = 1
Leaf: vec[3] = 4
Brother: vec[4] = 5
Root: vec[0] = 2
Leaf: vec[1] = 1
Brother: vec[2] = 3
Root: vec[0] = 1
Leaf: vec[1] = 2
Brother: vec[2] = 3
[1, 2, 3, 4, 5, 6, 6, 7, 8, 9, 10, 17, 12, 14, 19, 20, ]
habdig7official@MacBook-Pro-de-Mateus max_heapfy %

```

Figure 5: Heap Sort, 4<sup>a</sup> Página

# Code

The screenshot shows the Visual Studio Code interface on a Mac OS X desktop. The title bar reads "VSCode" and "max\_heapfy.c — max\_heapfy". The left sidebar shows a file tree with a folder named "MAX\_HEAPFY" containing files like ".minted", "vscode", ".gitignore", "heap", "heapsort1.png", "heapsort2.png", "heapsort3.png", "heapsort4.png", "max\_heapfy.c", "max\_heapfy.png", "relatorio.pdf", "relatorio.aux", "relatorio.log", "relatorio.out", "relatorio.pdf", and "relatorio.tex". The main editor area displays the C code for "max\_heapfy.c". The status bar at the bottom shows the author's name "Mateus Felipe da Silveira Vileira", the last update time "Vor 5 Stunden", and other details like "Zeile 23, Spalte 62", "Leerzeichen: 4", and "UTF-8".

```
#include <stdio.h>
#include <math.h>
#include <stdbool.h>

void print_vec(int *vec, int len){
    printf("(");
    for (int i = 0; i < len; i++){
        printf("%d ", vec[i]);
    }
    printf(")\n");
}

void swap(int *a, int *b){
    int aux = *a;
    *a = *b;
    *b = aux;
}

bool max_heapfy(int *vec, int i, int len){
    bool parity = (i % 2) == 0;
    int index_father = (int)i / 2 + (parity? -1 : 0);
    int index_brother = i + (parity ? -1 : 1);
    printf("Root: vec[%d] = %d\n", index_father, vec[index_father]);
    printf("Leaf: vec[%d] = %d\n", i, vec[i]);
    printf("Brother: vec[%d] = %d\n", index_brother, vec[index_brother]);
    printf("\n");

    if(index_brother >= len){
        return false;
    }

    int max_child = (vec[i] >= vec[index_brother])? i : index_brother;
    if(vec[max_child] > vec[index_father]){
        swap(&vec[index_father], &vec[max_child]);
    }

    printf("Troca: %d %d\n", vec[max_child], vec[index_father]);
    return true;
}

print_vec(vec, len);
return false;
}
```

Figure 6: Code, 1<sup>a</sup> Página

The screenshot shows the VS Code interface with the following details:

- Top Bar:** Shows the title "VSCode", file tabs like "Datei", "Bearbeiten", "Auswahl", "Anzeigen", "Gehe zu", "Ausführen", and "Terminal", and system status like "Fenster", "Hilfe", battery level, and date/time.
- Left Sidebar (Explorer):** Lists files in the current workspace, including "MAX\_HEAPFY", "heapsort1.png", "heapsort2.png", "heapsort3.png", "heapsort4.png", "max\_heapfy.c", and "max\_heapfy.png".
- Central Area (Editor):** Displays the code for "max\_heapfy.c". The code implements a max-heapify function and a main function that prints the heapified array and swaps elements if necessary. A red circle with a question mark is visible near the code editor.
- Bottom Status Bar:** Shows the terminal command "habdigi@oficialMacBook-Pro-de-Mateus max\_heapfy % pdflatex --shell-escape relatorio.tex &> open relatorio.pdf", the transcript file "Transcript Written on Relatorio.log", and other system information.

Figure 7: Code, 2<sup>a</sup> Página