Assignment 4

1)
The htags3 program is designed to extract unique HTML tags from an HTML file provided as a command-line parameter, utilizing dynamic memory allocation on the heap. It employs a parsing algorithm that reads the file line by line, identifying HTML tags enclosed within `<` and `>` characters while skipping over comment tags. Detected tags are stored as separate strings in a dynamically allocated array of pointers to characters (char **). Each time a tag is encountered, memory is dynamically allocated for it individually, and the total memory usage is updated accordingly. The program ensures uniqueness of tags by comparing them with previously stored tags. Before termination, all dynamically allocated memory is deallocated.

2)
#source code

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#define INITIAL_SIZE 100

char **tags = NULL;
int tagsCount = 0;
int totalAllocatedMemory = 0;

int isComment(const char *line) {
    return (line[0] == '<' && line[1] == '!' && line[2] == '-' &&
line[3] == '-');
}

void extractTags(const char *line) {
    const char *start = line;
    while ((start = strchr(start, '<')) != NULL) {
        const char *end = strchr(start, '>');
        if (end == NULL)
            break;
        if (!isComment(start)) {
            int length = end - start + 1;
            char *tag = (char *)malloc(length + 1);
            if (tag != NULL) {
                strncpy(tag, start, length);
                tag[length] = '\0';
                tagsCount++;
                tags = realloc(tags, tagsCount * sizeof(char *));
                tags[tagsCount - 1] = tag;
                totalAllocatedMemory += (length + 1);
                printf("Allocated %d bytes. Total allocated memory: %d
bytes.\n", length + 1, totalAllocatedMemory);
            } else {
```

1

```c
                printf("Memory allocation failed for tag: %s\n",
start);
            }
        }
        start = end + 1;
    }
}

void printUniqueTags() {
    for (int i = 0; i < tagsCount; i++) {
        int j;
        for (j = 0; j < i; j++) {
            if (strcmp(tags[i], tags[j]) == 0)
                break;
        }
        if (i == j)
            printf("%s\n", tags[i]);
    }
}

void freeMemory() {
    for (int i = 0; i < tagsCount; i++) {
        free(tags[i]);
    }
    free(tags);
}

int main(int argc, char *argv[]) {
    if (argc != 2) {
        printf("Usage: %s <filename>\n", argv[0]);
        return 1;
    }

    FILE *file = fopen(argv[1], "r");
    if (file == NULL) {
        printf("Error opening file %s\n", argv[1]);
        return 1;
    }

    char line[BUFSIZ];
    while (fgets(line, sizeof(line), file)) {
        extractTags(line);
    }
    fclose(file);

    printUniqueTags();
    freeMemory();

    return 0;
}
```
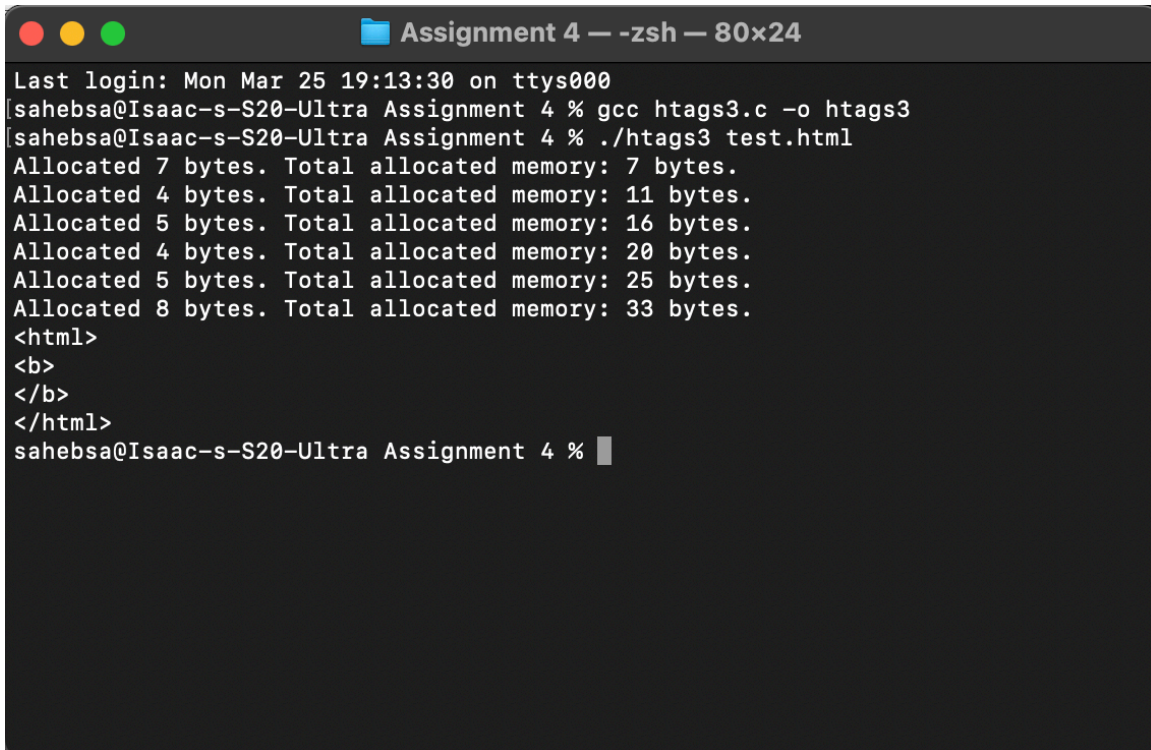
3)

```
Last login: Mon Mar 25 19:13:30 on ttys000
[sahebsa@Isaac-s-S20-Ultra Assignment 4 % gcc htags3.c -o htags3
[sahebsa@Isaac-s-S20-Ultra Assignment 4 % ./htags3 test.html
Allocated 7 bytes. Total allocated memory: 7 bytes.
Allocated 4 bytes. Total allocated memory: 11 bytes.
Allocated 5 bytes. Total allocated memory: 16 bytes.
Allocated 4 bytes. Total allocated memory: 20 bytes.
Allocated 5 bytes. Total allocated memory: 25 bytes.
Allocated 8 bytes. Total allocated memory: 33 bytes.
<html>
<b>
</b>
</html>
sahebsa@Isaac-s-S20-Ultra Assignment 4 %
```

3

4)

```
[sahebsa@Isaac-s-S20-Ultra Assignment 4 % ./htags3 A4W2024.html
Allocated 7 bytes. Total allocated memory: 7 bytes.
Allocated 7 bytes. Total allocated memory: 14 bytes.
Allocated 73 bytes. Total allocated memory: 87 bytes.
Allocated 61 bytes. Total allocated memory: 148 bytes.
Allocated 8 bytes. Total allocated memory: 156 bytes.
Allocated 9 bytes. Total allocated memory: 165 bytes.
Allocated 8 bytes. Total allocated memory: 173 bytes.
Allocated 73 bytes. Total allocated memory: 246 bytes.
Allocated 25 bytes. Total allocated memory: 271 bytes.
Allocated 20 bytes. Total allocated memory: 291 bytes.
Allocated 4 bytes. Total allocated memory: 295 bytes.
Allocated 8 bytes. Total allocated memory: 303 bytes.
Allocated 5 bytes. Total allocated memory: 308 bytes.
Allocated 5 bytes. Total allocated memory: 313 bytes.
Allocated 20 bytes. Total allocated memory: 333 bytes.
Allocated 4 bytes. Total allocated memory: 337 bytes.
Allocated 8 bytes. Total allocated memory: 345 bytes.
Allocated 5 bytes. Total allocated memory: 350 bytes.
Allocated 5 bytes. Total allocated memory: 355 bytes.
Allocated 20 bytes. Total allocated memory: 375 bytes.
Allocated 4 bytes. Total allocated memory: 379 bytes.
Allocated 8 bytes. Total allocated memory: 387 bytes.
Allocated 5 bytes. Total allocated memory: 392 bytes.
Allocated 5 bytes. Total allocated memory: 397 bytes.
Allocated 47 bytes. Total allocated memory: 444 bytes.
Allocated 8 bytes. Total allocated memory: 452 bytes.
Allocated 5 bytes. Total allocated memory: 457 bytes.
Allocated 20 bytes. Total allocated memory: 477 bytes.
Allocated 4 bytes. Total allocated memory: 481 bytes.
Allocated 62 bytes. Total allocated memory: 543 bytes.
Allocated 4 bytes. Total allocated memory: 547 bytes.
Allocated 5 bytes. Total allocated memory: 552 bytes.
Allocated 8 bytes. Total allocated memory: 560 bytes.
Allocated 5 bytes. Total allocated memory: 565 bytes.
Allocated 5 bytes. Total allocated memory: 570 bytes.
Allocated 20 bytes. Total allocated memory: 590 bytes.
Allocated 62 bytes. Total allocated memory: 652 bytes.
Allocated 8 bytes. Total allocated memory: 660 bytes.
Allocated 5 bytes. Total allocated memory: 665 bytes.
Allocated 20 bytes. Total allocated memory: 685 bytes.
Allocated 62 bytes. Total allocated memory: 747 bytes.
Allocated 57 bytes. Total allocated memory: 804 bytes.
Allocated 8 bytes. Total allocated memory: 812 bytes.
Allocated 5 bytes. Total allocated memory: 817 bytes.
Allocated 8 bytes. Total allocated memory: 825 bytes.
Allocated 5 bytes. Total allocated memory: 830 bytes.
Allocated 20 bytes. Total allocated memory: 850 bytes.
Allocated 51 bytes. Total allocated memory: 901 bytes.
Allocated 8 bytes. Total allocated memory: 909 bytes.
Allocated 5 bytes. Total allocated memory: 914 bytes.
Allocated 4 bytes. Total allocated memory: 918 bytes.
Allocated 8 bytes. Total allocated memory: 926 bytes.
Allocated 5 bytes. Total allocated memory: 931 bytes.
Allocated 5 bytes. Total allocated memory: 936 bytes.
Allocated 4 bytes. Total allocated memory: 940 bytes.
Allocated 5 bytes. Total allocated memory: 945 bytes.
```

4

```
Allocated 20 bytes. Total allocated memory: 850 bytes.
Allocated 51 bytes. Total allocated memory: 901 bytes.
Allocated 8 bytes. Total allocated memory: 909 bytes.
Allocated 5 bytes. Total allocated memory: 914 bytes.
Allocated 4 bytes. Total allocated memory: 918 bytes.
Allocated 8 bytes. Total allocated memory: 926 bytes.
Allocated 5 bytes. Total allocated memory: 931 bytes.
Allocated 5 bytes. Total allocated memory: 936 bytes.
Allocated 4 bytes. Total allocated memory: 940 bytes.
Allocated 5 bytes. Total allocated memory: 945 bytes.
Allocated 8 bytes. Total allocated memory: 953 bytes.
Allocated 52 bytes. Total allocated memory: 1005 bytes.
Allocated 8 bytes. Total allocated memory: 1013 bytes.
Allocated 8 bytes. Total allocated memory: 1021 bytes.
Allocated 8 bytes. Total allocated memory: 1029 bytes.
Allocated 8 bytes. Total allocated memory: 1037 bytes.
Allocated 8 bytes. Total allocated memory: 1045 bytes.
Allocated 8 bytes. Total allocated memory: 1053 bytes.
Allocated 8 bytes. Total allocated memory: 1061 bytes.
Allocated 4 bytes. Total allocated memory: 1065 bytes.
Allocated 5 bytes. Total allocated memory: 1070 bytes.
Allocated 4 bytes. Total allocated memory: 1074 bytes.
Allocated 5 bytes. Total allocated memory: 1079 bytes.
Allocated 8 bytes. Total allocated memory: 1087 bytes.
Allocated 5 bytes. Total allocated memory: 1092 bytes.
Allocated 8 bytes. Total allocated memory: 1100 bytes.
Allocated 5 bytes. Total allocated memory: 1105 bytes.
Allocated 72 bytes. Total allocated memory: 1177 bytes.
Allocated 8 bytes. Total allocated memory: 1185 bytes.
Allocated 5 bytes. Total allocated memory: 1190 bytes.
Allocated 8 bytes. Total allocated memory: 1198 bytes.
Allocated 5 bytes. Total allocated memory: 1203 bytes.
Allocated 62 bytes. Total allocated memory: 1265 bytes.
Allocated 8 bytes. Total allocated memory: 1273 bytes.
Allocated 8 bytes. Total allocated memory: 1281 bytes.
Allocated 62 bytes. Total allocated memory: 1343 bytes.
Allocated 8 bytes. Total allocated memory: 1351 bytes.
Allocated 8 bytes. Total allocated memory: 1359 bytes.
Allocated 62 bytes. Total allocated memory: 1421 bytes.
Allocated 8 bytes. Total allocated memory: 1429 bytes.
Allocated 5 bytes. Total allocated memory: 1434 bytes.
Allocated 62 bytes. Total allocated memory: 1496 bytes.
Allocated 8 bytes. Total allocated memory: 1504 bytes.
Allocated 8 bytes. Total allocated memory: 1512 bytes.
Allocated 51 bytes. Total allocated memory: 1563 bytes.
Allocated 4 bytes. Total allocated memory: 1567 bytes.
Allocated 5 bytes. Total allocated memory: 1572 bytes.
Allocated 8 bytes. Total allocated memory: 1580 bytes.
Allocated 5 bytes. Total allocated memory: 1585 bytes.
Allocated 8 bytes. Total allocated memory: 1593 bytes.
Allocated 8 bytes. Total allocated memory: 1601 bytes.
Allocated 51 bytes. Total allocated memory: 1652 bytes.
Allocated 8 bytes. Total allocated memory: 1660 bytes.
Allocated 52 bytes. Total allocated memory: 1712 bytes.
Allocated 8 bytes. Total allocated memory: 1720 bytes.
Allocated 8 bytes. Total allocated memory: 1728 bytes.
Allocated 5 bytes. Total allocated memory: 1733 bytes.
```

```
Allocated 8 bytes. Total allocated memory: 1728 bytes.
Allocated 5 bytes. Total allocated memory: 1733 bytes.
Allocated 5 bytes. Total allocated memory: 1738 bytes.
Allocated 8 bytes. Total allocated memory: 1746 bytes.
Allocated 5 bytes. Total allocated memory: 1751 bytes.
Allocated 62 bytes. Total allocated memory: 1813 bytes.
Allocated 8 bytes. Total allocated memory: 1821 bytes.
Allocated 8 bytes. Total allocated memory: 1829 bytes.
Allocated 51 bytes. Total allocated memory: 1880 bytes.
Allocated 8 bytes. Total allocated memory: 1888 bytes.
Allocated 52 bytes. Total allocated memory: 1940 bytes.
Allocated 8 bytes. Total allocated memory: 1948 bytes.
Allocated 8 bytes. Total allocated memory: 1956 bytes.
Allocated 8 bytes. Total allocated memory: 1964 bytes.
Allocated 62 bytes. Total allocated memory: 2026 bytes.
Allocated 8 bytes. Total allocated memory: 2034 bytes.
Allocated 5 bytes. Total allocated memory: 2039 bytes.
Allocated 62 bytes. Total allocated memory: 2101 bytes.
Allocated 8 bytes. Total allocated memory: 2109 bytes.
Allocated 8 bytes. Total allocated memory: 2117 bytes.
Allocated 51 bytes. Total allocated memory: 2168 bytes.
Allocated 8 bytes. Total allocated memory: 2176 bytes.
Allocated 52 bytes. Total allocated memory: 2228 bytes.
Allocated 8 bytes. Total allocated memory: 2236 bytes.
Allocated 8 bytes. Total allocated memory: 2244 bytes.
Allocated 8 bytes. Total allocated memory: 2252 bytes.
Allocated 62 bytes. Total allocated memory: 2314 bytes.
Allocated 8 bytes. Total allocated memory: 2322 bytes.
Allocated 5 bytes. Total allocated memory: 2327 bytes.
Allocated 62 bytes. Total allocated memory: 2389 bytes.
Allocated 8 bytes. Total allocated memory: 2397 bytes.
Allocated 5 bytes. Total allocated memory: 2402 bytes.
Allocated 8 bytes. Total allocated memory: 2410 bytes.
Allocated 5 bytes. Total allocated memory: 2415 bytes.
Allocated 20 bytes. Total allocated memory: 2435 bytes.
Allocated 62 bytes. Total allocated memory: 2497 bytes.
Allocated 8 bytes. Total allocated memory: 2505 bytes.
Allocated 5 bytes. Total allocated memory: 2510 bytes.
Allocated 7 bytes. Total allocated memory: 2517 bytes.
Allocated 8 bytes. Total allocated memory: 2525 bytes.
Allocated 8 bytes. Total allocated memory: 2533 bytes.
<html>
<head>
<meta http-equiv=Content-Type content="text/html; charset=windows-1252">
<meta name=Generator content="Microsoft Word 15 (filtered)">
<style>
</style>
</head>
<body lang=EN-CA link=blue vlink="#954F72" style='word-wrap:break-word'>
<div class=WordSection1>
<p class=MsoNormal>
<b>
</span>
</b>
</p>
<p class=MsoNormal style='text-align:justify'>
<u>
```

```
<style>
</style>
</head>
<body lang=EN-CA link=blue vlink="#954F72" style='word-wrap:break-word'>
<div class=WordSection1>
<p class=MsoNormal>
<b>
</span>
</b>
</p>
<p class=MsoNormal style='text-align:justify'>
<u>
<span lang=EN-US style='font-family:"Times New Roman",serif'>
</u>
<a href="https://www.educba.com/types-of-tags-in-html/">
</a>
<span style='font-family:"Times New Roman",serif'>
<i>
</i>
<span lang=EN-US style='font-family:"Courier New"'>
<p class=MsoBodyTextIndent style='margin-top:6.0pt;line-height:12.0pt'>
<br>
</div>
</body>
</html>
sahebsa@Isaac-s-S20-Ultra Assignment 4 %
```

5)

```
[sahebsa@Isaac-s-S20-Ultra Assignment 4 % gcc htags3.c -o htags3
[sahebsa@Isaac-s-S20-Ultra Assignment 4 % ./htags3 my.html
Allocated 7 bytes. Total allocated memory: 7 bytes.
Allocated 7 bytes. Total allocated memory: 14 bytes.
Allocated 8 bytes. Total allocated memory: 22 bytes.
Allocated 9 bytes. Total allocated memory: 31 bytes.
Allocated 8 bytes. Total allocated memory: 39 bytes.
Allocated 7 bytes. Total allocated memory: 46 bytes.
Allocated 5 bytes. Total allocated memory: 51 bytes.
Allocated 6 bytes. Total allocated memory: 57 bytes.
Allocated 4 bytes. Total allocated memory: 61 bytes.
Allocated 5 bytes. Total allocated memory: 66 bytes.
Allocated 8 bytes. Total allocated memory: 74 bytes.
Allocated 8 bytes. Total allocated memory: 82 bytes.
<html>
<head>
<title>
</title>
</head>
<body>
<h1>
</h1>
<p>
</p>
</body>
</html>
sahebsa@Isaac-s-S20-Ultra Assignment 4 %
```