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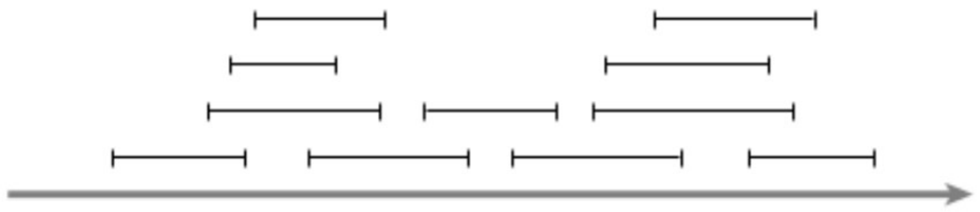
MTCT 1st Year, 1st Semester

Programming Lab
Assignment - 8

Questions:

1. 1.In a college with just one air conditioned room there are many requests to schedule activities in that room. Assume there are n requests numbered 1, 2, . . . , n. Each activity has a start times(i) and finish time f(i). At any point in time the room can be allocated only to one activity. So,if some set of activities have overlapping time intervals then only one of them can get that room. The problem is to find a subset of maximum size that has non-overlapping activities so that the maximum number of activities can use the room during the day. Output for a set of 11 activities and a subset of size 4 is shown below for reference that is the maximum sized subset of non-overlapping activities that can be scheduled.



2. The Edit Distance (or Levenshtein distance) is a metric for measuring the amount of difference between two strings. – The Edit Distance is defined as the minimum number of edits needed to transform one string into the other. The problem of finding an edit distance between two strings is as follows (i.e. the minimum distance to convert one string to another string): – Given an initial string s, and a target string t, what is the minimum number of changes that have to be applied to s to turn it into t ?

   The list of valid changes are:

   i. Inserting a character
   ii. Deleting a character
   iii. Changing a character to another character (replace).

   Examples:

   a) Input: str1 = “bmsse", str2 = “bmscse" Output: 1 We can convert str1 into str2 by inserting a ‘c'.
   b) Input: str1 = "cat", str2 = "cut" Output: 1 We can convert str1 into str2 by replacing 'a' with 'u'.
   c) Input: str1 = "sunday", str2 = "saturday" Output: 3 Last three and first characters are same. We basically need to convert "un" to "atur". This can be done using below three operations. Replace 'n' with 'r', insert t, insert a

   Write a program in C that will take two strings as input and print the edit distance between those.

CODE

interval_schedule.c

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

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

int partition(int arr[][2], int begin, int end) {
   int pivot = arr[end][1];
   int i = begin - 1;

   for (int j=begin; j<end; j++) {
       if (arr[j][1] < pivot) {
           i++;
           swap(&arr[j][1], &arr[i][1]);
       }
   }
   swap(&arr[i+1][1], &arr[end][1]);

   return i+1;
}

void quick_sort(int arr[][2], int begin, int end) {
   int pivot;

   if (begin < end) {
       pivot = partition(arr, begin, end);
       quick_sort(arr, begin, pivot-1);
       quick_sort(arr, pivot+1, end);
   }
}
```

```c
int *interval_scheduler(int tasks[][2], int len) {
   int j, *res_set = NULL;

   quick_sort(tasks, 0, len-1);
   res_set = malloc(len*sizeof(int)); // store indices of tasks
   if(res_set == NULL) {
       printf("MEMORY ALLOCATION ERROR.\n");
       exit(-1);
   }

   // add tasks[0]
   res_set[0] = 0;
   j = 1;
   for(int i=1; i<len; i++) {
       // if start time of tasks[i] greater than end time of last task
taken
       if(tasks[i][0] >= tasks[res_set[j-1]][1]) {
           res_set[j++] = i;
       }
   }

   // fill remaining part of res_set with some invalid int to indicate
end
   while(j<len) {
       res_set[j++] = -1;
   }
   return res_set;
}

int main() {
   int tasks[10][2] =
{{0,4},{1,2},{2,4},{3,5},{3,6},{5,6},{5,7},{6,7},{7,9},{8,10}};
   int *res = interval_scheduler(tasks, 10);

   printf("Given Tasks: \n");
   for(int i=0; i<10; i++) {
       printf("(%d, %d), ", tasks[i][0], tasks[i][1]);
```

```c
    }

    printf("\n\nSchedule of maximum non-overlapping tasks: \n");
    for(int i=0; i<10; i++) {
        if(res[i] == -1) {
            break;
        }
        printf("(%d, %d), ", tasks[res[i]][0], tasks[res[i]][1]);
    }
    printf("\n");

    free(res);
    return 0;
}
```

edit_dist.c

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

int min(int a, int b, int c) {
    int curr_min = a;

    if(b < curr_min) {
        curr_min = b;
    }
    if(c < curr_min) {
        curr_min = c;
    }

    return curr_min;
}

int edit_dist(char *str1, char *str2, int str1_indx, int str2_indx, int
**memo) {
    /* Convert str1 to str2 */
    if(str1_indx < 0) {
        /* add remaining chars of str2 to str1 to make them equal
        no of insertions = no of chars left in str2 = str2_indx + 1 */
        return str2_indx + 1;
    }
    if(str2_indx < 0) {
        /* delete remaining chars of str1 to make str1 == str2
         no of deletions = no of chars left in str1 = str1_indx + 1 */
        return str1_indx + 1;
    }

    if(memo[str2_indx][str1_indx] != -1) {
        return memo[str2_indx][str1_indx];
    } else {
        if(str1[str1_indx] == str2[str2_indx]) {
            // no new operations. just move one indx back
            memo[str2_indx][str1_indx] = edit_dist(str1, str2,
str1_indx-1, str2_indx-1, memo);
            return memo[str2_indx][str1_indx];
        } else { //+1 for 1 operation
            //replace
            /* replace char at str1_indx (then str1[str1_indx] ==
str2[str2_indx])
             move back one indx now */
            int replace = 1 + edit_dist(str1, str2, str1_indx-1,
str2_indx-1, memo);

            //insert
            /* insert after str_indx1. (then str1[str1_indx+1] ==
str2[str2_indx])
             move back one indx now */
            int insert = 1 + edit_dist(str1, str2, str1_indx,
str2_indx-1, memo);

            //delete
            /* delete at str_indx1. pointer moves to str1_indx-1.
             stay at str2_indx and compare with str1_indx-1 */
            int delete = 1 + edit_dist(str1, str2, str1_indx-1,
str2_indx, memo);

            memo[str2_indx][str1_indx] = min(replace, insert, delete);
            return memo[str2_indx][str1_indx];
        }
    }
}

int main() {
   char *str1 = NULL, *str2 = NULL;
   int **memo = NULL, res, len1, len2;
   char *inp[] = {"bmsse", "cat", "sunday"};
   char *outp[] = {"bmscse", "cut", "saturday"};

   for (int i=0; i<3; i++) {
       str1 = inp[i];
       str2 = outp[i];
       len1 = strlen(str1);
       len2 = strlen(str2);

       memo = malloc(len2*sizeof(int *));
       if(memo == NULL) {
           printf("MEMORY ALLOCATION ERROR.\n");
           exit(-1);
       }
       for(int i=0; i<len2; i++) {
           memo[i] = malloc(len1*sizeof(int));
           if(memo[i] == NULL) {
               printf("MEMORY ALLOCATION ERROR.\n");
               exit(-1);
           }
           for(int j=0; j<len1; j++) {
               memo[i][j] = -1;
           }
       }
```

```
        res = edit_dist(str1, str2, len1-1, len2-1, memo);
        printf("%s -> %s: Edit Dist = %d\n", str1, str2, res);

        for(int i=0; i<len2; i++) {
            free(memo[i]);
        }
        free(memo);
    }

    return 0;
}
```

OUTPUTS

interval_schedule.c

```
Given Tasks:
(0, 2), (1, 4), (2, 4), (3, 5), (3, 6), (5, 6), (5, 7), (6, 7), (7, 9),
(8, 10),

Schedule of maximum non-overlapping tasks:
(0, 2), (2, 4), (5, 6), (6, 7), (7, 9),
```

edit_dist.c

```
bmsse -> bmscse: Edit Dist = 1
cat -> cut: Edit Dist = 1
sunday -> saturday: Edit Dist = 3
```