알고리즘 과제

Practice.09

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9-1 All-Pairs Shortest Paths and Matrix Multiplication

- 알고리즘 설명

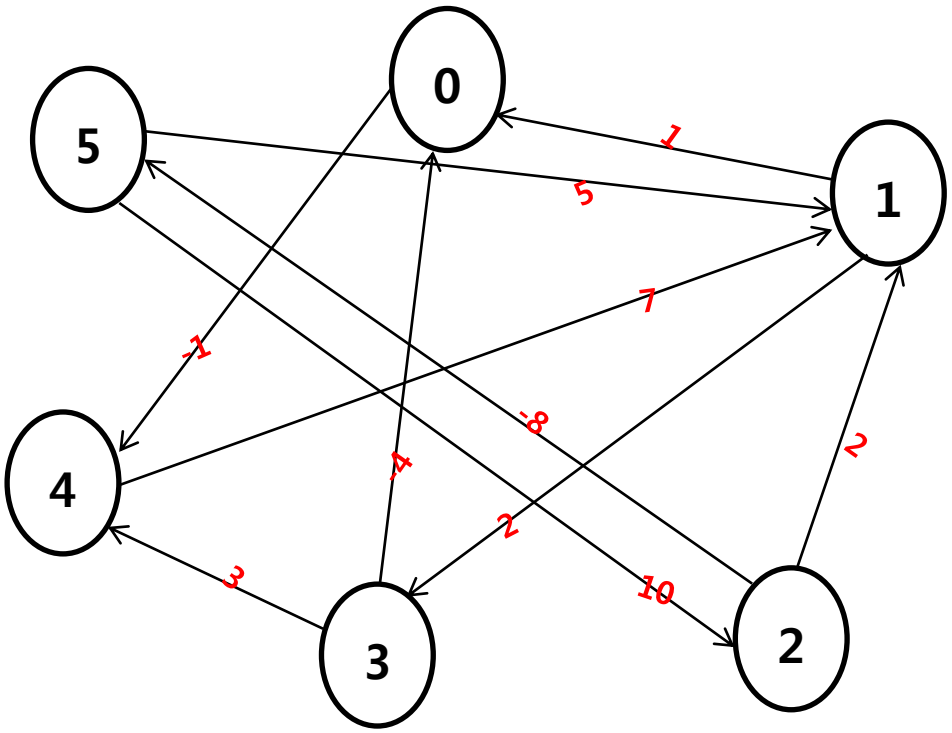
  L'행렬을 INF 로 초기화 후 L 행렬의 원소 l 과 W 행렬의 원소 w 를 이용해서 최소 비용을 L'에 저장한다. 같은 작업을 모든 행렬에 반복

- 컴파일 방법

  graph_sample_bellman.txt 파일을 바탕화면에 넣는다

  C:₩₩Users₩₩Administrator₩₩Desktop₩₩graph_sample_bellman.txt

- **Shortest Path**



<직접 찾은 값>

0 to 1 : 0 – 4 – 1 : 6 (-1+7)

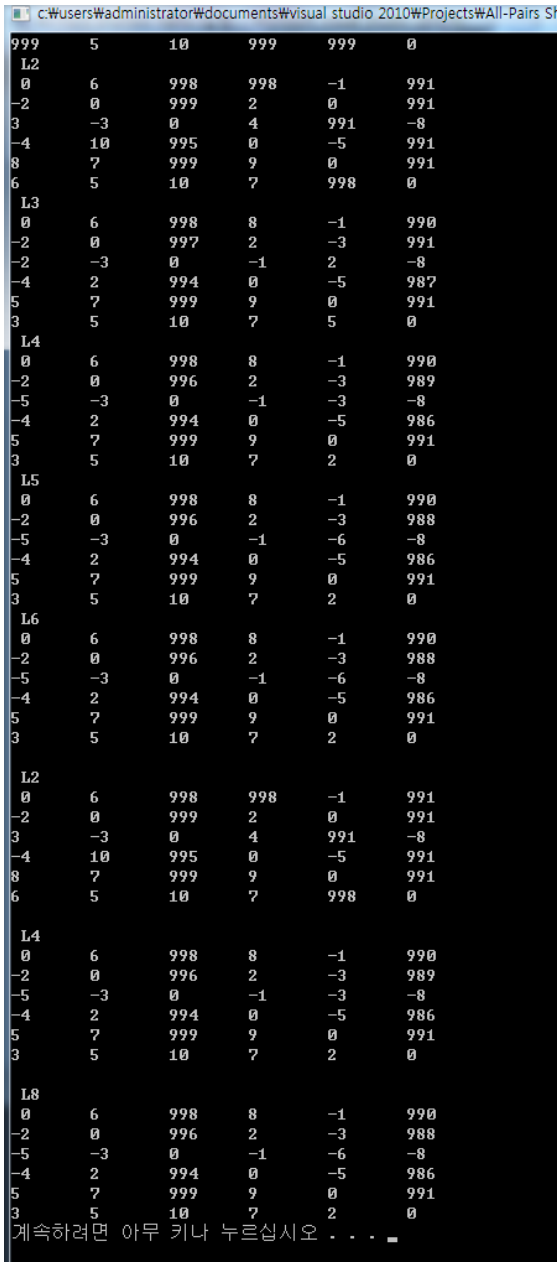
0 to 2 : 0 – 4 – 1 – 3 – 0 : 길 없음

0 to 3 : 0 – 4 – 1 – 3 : 8 (-1+7+2)

0 to 4 : 0 – 4 : -1

0 to 5 : 0 – 4 – 1 – 3 – 0 : 길 없음

<프로그램 결과값>


c:₩users₩administrator₩documents₩visual studio 2010₩Projects₩All-Pairs Sh
999 5 10 999 999 0
L2
0 6 998 998 -1 991
-2 0 999 2 0 991
3 -3 0 4 991 -8
-4 10 995 0 -5 991
8 7 999 9 0 991
6 5 10 7 998 0
L3
0 6 998 8 -1 990
-2 0 997 2 -3 991
-2 -3 0 -1 2 -8
-4 2 994 0 -5 987
5 7 999 9 0 991
3 5 10 7 5 0
L4
0 6 998 8 -1 990
-2 0 996 2 -3 989
-5 -3 0 -1 -3 -8
-4 2 994 0 -5 986
5 7 999 9 0 991
3 5 10 7 2 0
L5
0 6 998 8 -1 990
-2 0 996 2 -3 988
-5 -3 0 -1 -6 -8
-4 2 994 0 -5 986
5 7 999 9 0 991
3 5 10 7 2 0
L6
0 6 998 8 -1 990
-2 0 996 2 -3 988
-5 -3 0 -1 -6 -8
-4 2 994 0 -5 986
5 7 999 9 0 991
3 5 10 7 2 0
L2
0 6 998 998 -1 991
-2 0 999 2 0 991
3 -3 0 4 991 -8
-4 10 995 0 -5 991
8 7 999 9 0 991
6 5 10 7 998 0
L4
0 6 998 8 -1 990
-2 0 996 2 -3 989
-5 -3 0 -1 -3 -8
-4 2 994 0 -5 986
5 7 999 9 0 991
3 5 10 7 2 0
L8
0 6 998 8 -1 990
-2 0 996 2 -3 988
-5 -3 0 -1 -6 -8
-4 2 994 0 -5 986
5 7 999 9 0 991
3 5 10 7 2 0
계속하려면 아무 키나 누르십시오 . . .

Code (.C)

```
#define _CRT_SECURE_NO_WARNINGS
#include<stdio.h>
#include<stdlib.h>

#define INF 999 ; // Max, inf

int ver = 0 ;
void insertGraph() ;

int setViaVerSize(){

        int ver = 0 ;
        FILE *fps ;
        int num1 = 0;
        fps = fopen("C:₩₩Users₩₩Administrator₩₩Desktop₩₩graph_sample_directed.txt","rt");
        fscanf(fps,"%d",&num1);
        ver = num1;

        fclose(fps);
        return ver ;
}

int **setVia(int **arr){
        FILE *fps ;
        int i ;
        int num1 = 0 ;
        int num2 = 0 ;
        int     num3 = 0 ;
        int num4 = 0 ;

        fps = fopen("C:₩₩Users₩₩Administrator₩₩Desktop₩₩graph_sample_directed.txt","rt");
        fscanf(fps,"%d",&num1) ;

        for(i=0; i<10; i++){
                fscanf(fps,"%d %d %d",&num2, &num3, &num4);
                insertGraph(arr, num2, num3, num4);
        }

        fclose(fps);

        return arr ;
}

void insertGraph(int **A,int num2,int num3,int num4){
        *(*(A+num2)+num3) = num4;
}

int **Extend_Shortest_Paths(int **L,int **A){
        int **L_new ;
        int i,j,k,temp ;
        int min = INF ;

        L_new = (int **)malloc (sizeof(int*)*ver) ;
```

```
        for(i=0; i<ver; i++){
                *(L_new + i) = (int*)malloc(sizeof(int)*ver) ;
        }

        for(i=0 ; i<ver ; i++){
                for(j=0 ; j<ver ; j++){
                        L_new[i][j] = INF ;
                        for(k=0 ; k<ver ; k++){
                                temp = L[i][k] + A[k][j] ;
                                if(L_new[i][j] > temp) // 최00소ù0ù0비¬ㄱ®©-n용-e-e
저uu장aa
                                        L_new[i][j] = temp;
                        }
                }
        }
        return L_new ;
}

int **SAPSP(int **A){
        int **newL ;
        int num=1 ;
        int m,a,b,i ;

        newL = (int **)malloc (sizeof(int*)*ver);

        for(i=0; i<ver; i++){
                *(newL + i) = (int*)malloc(sizeof(int)*ver) ;
        }
        for(a=0; a<ver; a++){
                for(b=0; b<ver; b++){
                        newL[a][b]=A[a][b] ;
                }
        }

        for(m=0; m<ver-1; m++){
                newL = Extend_Shortest_Paths(newL,A) ;
                num++ ;
                printf(" L%d₩n ",num) ;

                for(a=0; a<ver; a++){
                        for(b=0; b<ver; b++){
                                printf("%d₩t",newL[a][b]) ;
                        }
                        printf("₩n") ;
                }
        }

        return newL ;
}
int **FAPSP(int **A){
        int **newL ;
        int **LL ;
        int num=1 ;
        int m=1 ;
```

```
        int a,b,i ;

        newL = (int **)malloc (sizeof(int*)*ver) ;

        for(i=0; i<ver; i++){
                *(newL + i) = (int*)malloc(sizeof(int)*ver) ;
        }
        for(a=0; a<ver; a++){
                for(b=0; b<ver; b++){
                        newL[a][b]=A[a][b] ;
                }
        }

        while(m < ver-1){
                newL = Extend_Shortest_Paths(newL,newL) ;
                printf("₩n") ;
                m = 2*m ;
                printf(" L%d₩n ",m) ;

                for(a=0 ; a<ver ; a++){
                        for(b=0 ; b<ver ; b++){
                                printf("%d₩t",newL[a][b]) ;
                        }
                        printf("₩n") ;
                }
        }

        return newL ;
}

int main(void){
        int **graph = NULL ;
        int i, a, b ;

        ver = setViaVerSize() ;

        graph = (int **)malloc (sizeof(int*)*ver);
        for(i=0; i<ver; i++){
                *(graph + i) = (int*)malloc(sizeof(int)*ver);
        }
        for(a=0; a<ver; a++){
                for(b=0; b<ver; b++){
                        if(a==b)
                                graph[a][b]=0;
                        else
                                graph[a][b]=INF;
                }
        }

        **setVia(graph);
        printf(" L1₩n ") ;

        for(a=0; a<ver; a++){
                for(b=0 ; b<ver ; b++){
                        printf("%d₩t",graph[a][b]) ;
```

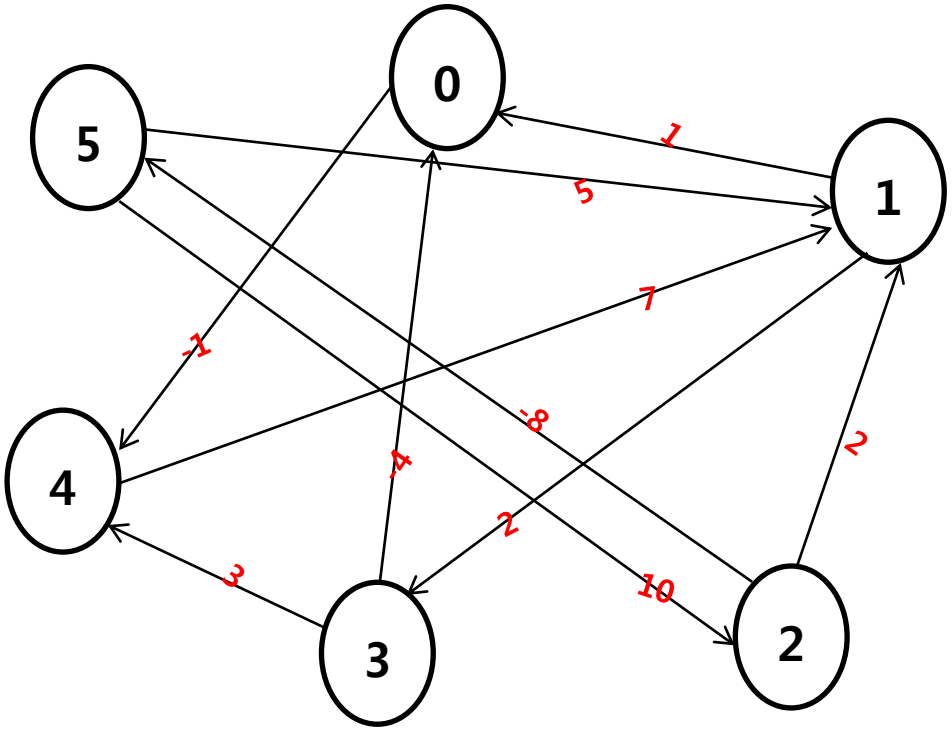
```
                }
                printf("₩n") ;
        }

        **SAPSP(graph) ;
        **FAPSP(graph) ;

        system("pause") ;

}
```

9-2 The Floyd-Warshall Algorithm

- 알고리즘 설명
  그래프에서 모든 꼭짓점 사이의 최단 경로의 거리를 구하여 가장 작은 값만 저장하는 알고리즘이다

- 컴파일 방법
  graph_sample_dijkstra.txt 파일을 바탕화면에 넣는다.
  C:₩₩Users₩₩Administrator₩₩Desktop₩₩ graph_sample_directed.txt

- **Shortest Path**



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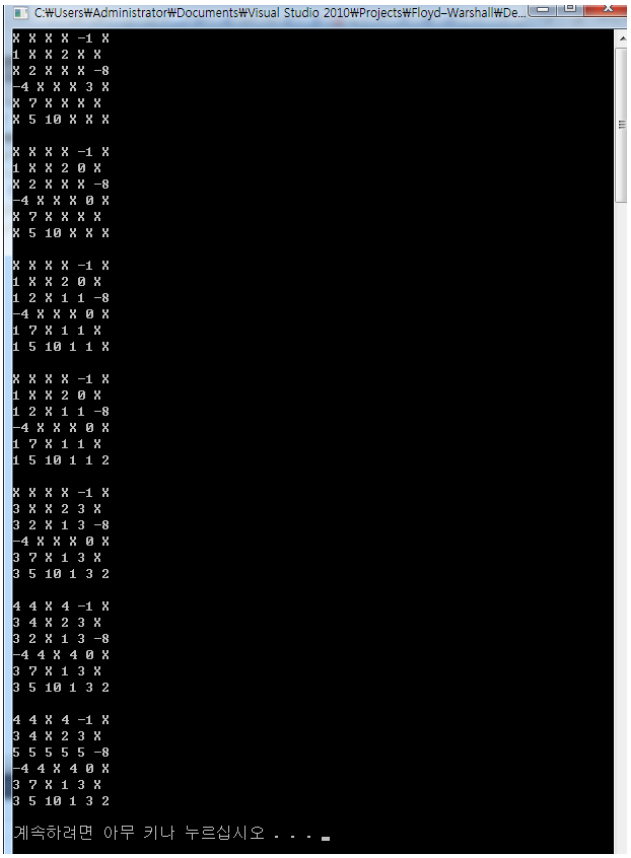
0 to 5 : 0 – 4 – 1 – 3 – 0 : 길 없음

<프로그램 결과값>


C:₩Users₩Administrator₩Documents₩Visual Studio 2010₩Projects₩Floyd-Warshall₩De...
X X X X -1 X
1 X X 2 X X
X 2 X X X -8
-4 X X X 3 X
X 7 X X X X
X 5 10 X X X
X X X X -1 X
1 X X 2 0 X
X 2 X X X -8
-4 X X X 0 X
X 7 X X X X
X 5 10 X X X
X X X X -1 X
1 X X 2 0 X
1 2 X 1 1 -8
-4 X X X 0 X
1 7 X 1 1 X
1 5 10 1 1 X
X X X X -1 X
1 X X 2 0 X
1 2 X 1 1 -8
-4 X X X 0 X
1 7 X 1 1 X
1 5 10 1 1 2
X X X X -1 X
3 X X 2 3 X
3 2 X 1 3 -8
-4 X X X 0 X
3 7 X 1 3 X
3 5 10 1 3 2
4 4 X 4 -1 X
3 4 X 2 3 X
3 2 X 1 3 -8
-4 4 X 4 0 X
3 7 X 1 3 X
3 5 10 1 3 2
4 4 X 4 -1 X
3 4 X 2 3 X
5 5 5 5 5 -8
-4 4 X 4 0 X
3 7 X 1 3 X
3 5 10 1 3 2
계속하려면 아무 키나 누르십시오 . . .

Code (.C)

```
#define _CRT_SECURE_NO_WARNINGS
#include <stdio.h>
#include <stdlib.h>
#include <memory.h>

#define N 6
#define inf 999

void printArray(int** arr)
{
        int i,j ;
    for(i=0 ; i<N ; i++){
                for(j=0 ; j<N ; j++){
                        if(arr[i][j]==inf)
                                printf("X ") ;
                        else
                                printf("%d ",arr[i][j]) ;
                }
                printf("₩n") ;
        }

        printf("₩n") ;
}

void getArr(int*num){
        FILE *fps ;
        int temp = 0 , i ;
        int n1, n2, n3 ;

        // input의C 숫ùy자U들ie을¡í 배öe열¯¡© num에¯¢® 저u장a하I는¥A 부ㄱI분ㄱ¨¢
        fps = fopen("C:₩₩Users₩₩Administrator₩₩Desktop₩₩graph_sample_directed.txt","rt");
        fscanf(fps,"%d",&temp) ;
        num[0] = temp ;
        for(i=1; i < 31 ; i=i+3){
                fscanf(fps,"%d %d %d",&n1, &n2, &n3) ;
                num[i] = n1 ;
                num[i+1] = n2 ;
                num[i+2] = n3 ;
        }

        fclose(fps) ;

}

int** doFloyd(int** via){
        // int** d = cost table
        int i, j, k ;
        int **d ; // Via Table.

        d = (int**)malloc(sizeof(int *)*N);
        for(i=0 ; i<N ; i++)
                d[i] = (int *)malloc(sizeof(int)*N);
```

```
        for(i=0 ; i<N ; i++)
                for(j=0 ; j<N ; j++)
                        d[i][j] = inf ;
        // Init
    for (i = 0; i < N; ++i)
    {
        for (j = 0; j < N; ++j)
        {
            d[i][j] = via[i][j];
        }
    }
                // Floyd-Warshall Algorithm
    for (k = 0; k < N; ++k){
        for (i = 0; i < N; ++i){
            for (j = 0; j < N; ++j){
                if (d[i][j] > d[i][k] + d[k][j] && d[i][k] != inf && d[k][j] != inf){
                    d[i][j] = d[i][k] + d[k][j] ;
                    via[i][j] = k ;
                }
            }
        }
                printArray(via) ;
    }
        return d ;
}

int** setCostTable(int* arr){
        int **array ;
        int i, j ;
        array = (int**)malloc(sizeof(int *)*N);
        for(i=0 ; i<N ; i++)
                array[i] = (int *)malloc(sizeof(int)*N);


        for(i=0 ; i<N ; i++)
                for(j=0 ; j<N ; j++)
                        array[i][j] = inf ;

        for(i=1 ; i<30 ; i=i+3 ){
                array[arr[i]][arr[i+1]] = arr[i+2] ;
        }

        return array ;
}
int main(void){
        int num[31], **d ;
        getArr(num) ; // Get Input Data
        d = setCostTable(num) ;
        printArray(d) ;
        doFloyd(d) ;
        system("pause") ;
    return 0;
}
```