

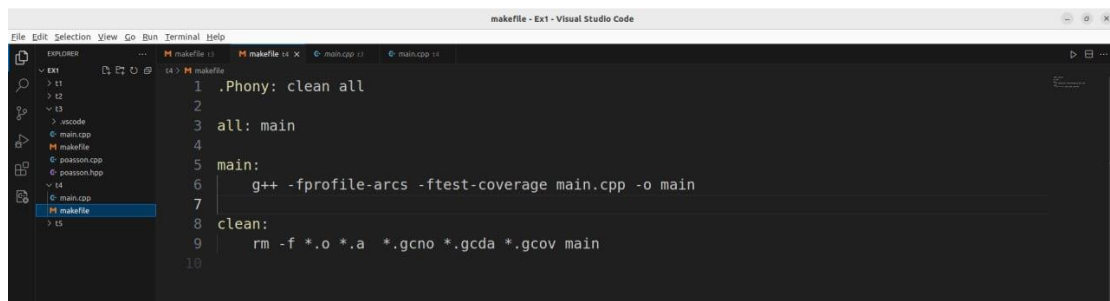
תרגיל 4 - דייקסטרא ושימוש ב gcov:

התרגיל משתמש בקליטת ערכי מטריצת שונויות NXN מהמשתמש.

התוכנית לא תקבל:

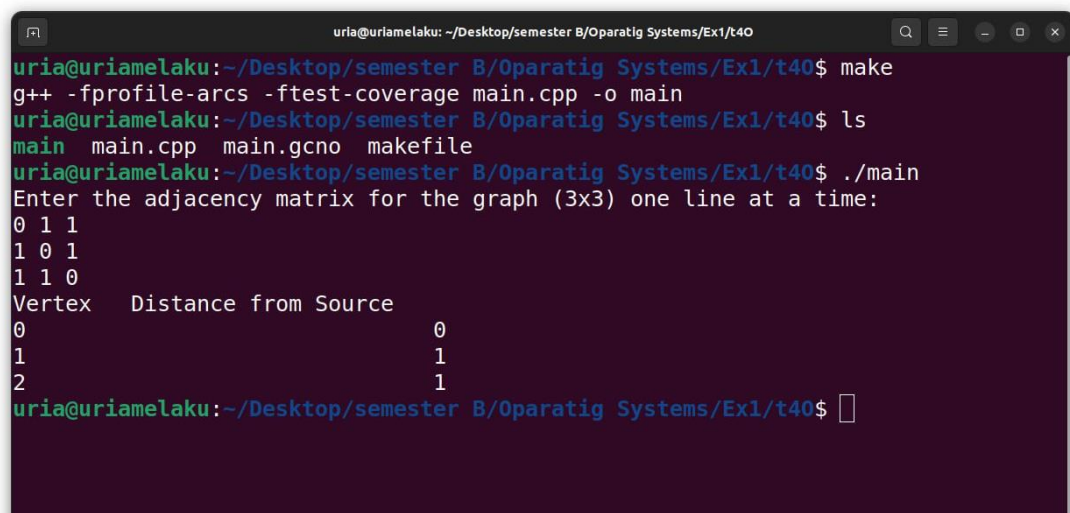
1. יותר מדי קשתות בשורה
2. קצת מידי או יותר מידי ערכים בשורה
3. קשתות במשקל שלילי
4. משקל קודקוד לעצמו חייב להיות 0
5. להכניס איבר אחד בשורה
6. להכניס אותיות במקום ספרות במטריצה
7. הכנסת רווח מיותר בשורה

זהו המייקפיל שמקמפל עם cov:



```
1 .Phony: clean all
2
3 all: main
4
5 main:
6     g++ -fprofile-arcs -ftest-coverage main.cpp -o main
7
8 clean:
9     rm -f *.o *.a *.gcno *.gcda *.gcov main
10
```

נקמפל ונריץ את התוכנית ללא תקלות:



```
uria@uriamelaku: ~/Desktop/semester B/Oparatig Systems/Ex1/t40
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ make
g++ -fprofile-arcs -ftest-coverage main.cpp -o main
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ ls
main main.cpp main.gcno makefile
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ ./main
Enter the adjacency matrix for the graph (3x3) one line at a time:
0 1 1
1 0 1
1 1 0
Vertex    Distance from Source
0          0
1          1
2          1
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$
```

כאן ניתן לראות כי כיסינו חלק משורות הקוד מכיוון שלא היו תקלות (ניתן לראות באחוזים):

```
uria@uriamelaku: ~/Desktop/semester B/Operatig Systems/Ex1/t40
uria@uriamelaku:~/Desktop/semester B/Operatig Systems/Ex1/t40$ gcov main.cpp
File 'main.cpp'
Lines executed:80.70% of 57
Creating 'main.cpp.gcov'

File '/usr/include/c++/11/iostream'
No executable lines
Removing 'iostream.gcov'

File '/usr/include/c++/11/bits/move.h'
Lines executed:0.00% of 2
Creating 'move.h.gcov'

File '/usr/include/c++/11/ext/new_allocator.h'
Lines executed:0.00% of 2
Creating 'new_allocator.h.gcov'

File '/usr/include/c++/11/bits/basic_string.h'
No executable lines
Removing 'basic_string.h.gcov'

Lines executed:75.41% of 61
uria@uriamelaku:~/Desktop/semester B/Operatig Systems/Ex1/t40$
```

ניתן לראות בפירוט לאיזה שורות נכנסו וכמה פעמים לכל שורה

```
uria@uriamelaku: ~/Desktop/semester B/Operatig Systems/Ex1/t40
uria@uriamelaku:~/Desktop/semester B/Operatig Systems/Ex1/t40$ cat main.cpp.gcov
-:      0:Source:main.cpp
-:      0:Graph:main.gcno
-:      0:Data:main.gcda
-:      0:Runs:1
-:      1:// C++ program for Dijkstra's single source shortest path
-:      2:// algorithm. The program is for adjacency matrix
-:      3:// representation of the graph
-:      4:#include <iostream>
-:      5:#include <vector>
-:      6:#include <limits.h>
-:      7:#include <sstream>
-:      8:using namespace std;
-:      9:
-:     10:// Number of vertices in the graph
-:     11:#define V 3
-:     12:
-:     13:// A utility function to find the vertex with minimum
-:     14:// distance value, from the set of vertices not yet included
-:     15:// in shortest path tree
2:    16:int minDistance(int dist[], bool sptSet[])
-:    17:{
-:    18:
-:    19:    // Initialize min value
```

```
uria@uriamelaku: ~/Desktop/semester B/Oparatig Systems/Ex1/t40
#####: 134:          cerr << "ERROR: Too many values in line " << i + 1 <
< ". Please provide exactly " << V << " integers per line." << endl;
#####: 135:          return false;
-: 136:      }
3: 137:  }
1: 138:  return true;
-: 139:}
-: 140:
1: 141:int main() {
-: 142:    int graph[V][V];
-: 143:
1: 144:    if (readGraph(graph))
-: 145:    {
1: 146:        dijkstra(graph, 0);
-: 147:    }
-: 148:    else
-: 149:    {
#####: 150:        cerr << "Failed to read graph. Please try again." << end
l;
-: 151:    }
-: 152:
1: 153:    return 0;
-: 154:}
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$
```

כעת נריץ את הקוד באופן שייכנס לכל שורותיו. כלומר על כל אפשרויות השגיאה שיכולות לקרות.
הרצתי את התוכנית באופן תקין, ועם איבר אחד:

```
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ make
g++ -fprofile-arcs -ftest-coverage main.cpp -o main
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ ./main
Enter the adjacency matrix for the graph (3x3) one line at a time:
0 1 1
1 0 1
1 1 0
Vertex    Distance from Source
0          0
1          1
2          1
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ ./main
Enter the adjacency matrix for the graph (3x3) one line at a time:
0
ERROR: Invalid input in line 1. Please provide exactly 3 integers per line.
Failed to read graph. Please try again.
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$
```

עכשיו נריץ עם אותיות במקום מספרים, עם ערך שאינו 0 באלכסון, ועם מספר שלילי:

```
uria@uriamelaku: ~/Desktop/semester B/Oparatig Systems/Ex1/t40
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ ./main
Enter the adjacency matrix for the graph (3x3) one line at a time:
r r r
ERROR: Invalid input in line 1. Please provide exactly 3 integers per line.
Failed to read graph. Please try again.
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ ./main
Enter the adjacency matrix for the graph (3x3) one line at a time:
1 1 1
ERROR: every edge from vertex to himself must be 0
Failed to read graph. Please try again.
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ ./main
Enter the adjacency matrix for the graph (3x3) one line at a time:
0 -1 1
ERROR: Negative edge weight detected. Dijkstra's algorithm does not support negative weights.
Failed to read graph. Please try again.
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$
```

כעת נריץ עם רווח מיותר בין המספרים, עם מעט מספרים בשורה, ועם יותר מידי ערכים בשורה:

```
uria@uriamelaku: ~/Desktop/semester B/Oparatig Systems/Ex1/t40
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ ./main
Enter the adjacency matrix for the graph (3x3) one line at a time:
0 1 1
ERROR: Invalid input in line 1. Extra spaces detected.
Failed to read graph. Please try again.
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ ./main
Enter the adjacency matrix for the graph (3x3) one line at a time:
0 1
ERROR: Invalid input in line 1. Please provide exactly 3 integers per line.
Failed to read graph. Please try again.
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ ./main
Enter the adjacency matrix for the graph (3x3) one line at a time:
0 1 2 3
ERROR: Too many values in line 1. Please provide exactly 3 integers per line.
Failed to read graph. Please try again.
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$
```


נראה שעכשיו כיסינו 100% מהקוד:

```
uria@uriamelaku: ~/Desktop/semester B/Oparatig Systems/Ex1/t40
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ gcov main.cpp
File 'main.cpp'
Lines executed:100.00% of 57
Creating 'main.cpp.gcov'

File '/usr/include/c++/11/iostream'
No executable lines
Removing 'iostream.gcov'

File '/usr/include/c++/11/bits/move.h'
Lines executed:0.00% of 2
Creating 'move.h.gcov'

File '/usr/include/c++/11/ext/new_allocator.h'
Lines executed:0.00% of 2
Creating 'new_allocator.h.gcov'

File '/usr/include/c++/11/bits/basic_string.h'
No executable lines
Removing 'basic_string.h.gcov'

Lines executed:93.44% of 61
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$
```

נראה שאכן נכנסנו לכל שורות הקוד:

```
uria@uriamelaku: ~/Desktop/semester B/Oparatig Systems/Ex1/t40
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$ cat main.cpp.gcov
-:      0:Source:main.cpp
-:      0:Graph:main.gcho
-:      0:Data:main.gcda
-:      0:Runs:8
-:      1:// C++ program for Dijkstra's single source shortest path
-:      2:// algorithm. The program is for adjacency matrix
-:      3:// representation of the graph
-:      4:#include <iostream>
-:      5:#include <vector>
-:      6:#include <limits.h>
-:      7:#include <sstream>
-:      8:using namespace std;
-:      9:
-:     10:// Number of vertices in the graph
-:     11:#define V 3
-:     12:
-:     13:// A utility function to find the vertex with minimum
-:     14:// distance value, from the set of vertices not yet included
-:     15:// in shortest path tree
-:     16:int minDistance(int dist[], bool sptSet[])
-:     17:{
-:     18:
-:     19:    // Initialize min value
```

```
uria@uriamelaku: ~/Desktop/semester B/Oparatig Systems/Ex1/t40
1: 134:          cerr << "ERROR: Too many values in line " << i + 1 <
< ". Please provide exactly " << V << " integers per line." << endl;
1: 135:          return false;
-: 136:      }
17: 137:  }
1: 138:  return true;
-: 139:}
-: 140:
8: 141:int main() {
-: 142:    int graph[V][V];
-: 143:
8: 144:    if (readGraph(graph))
-: 145:    {
1: 146:        dijkstra(graph, 0);
-: 147:    }
-: 148:    else
-: 149:    {
7: 150:        cerr << "Failed to read graph. Please try again." << end
l;
-: 151:    }
-: 152:
8: 153:    return 0;
-: 154:}
uria@uriamelaku:~/Desktop/semester B/Oparatig Systems/Ex1/t40$
```