

פרויקט גמר מערכות הפעלה:

מגישות: 209948058_207300823

הסבר+הרצה:

ניתן לראות שהלכה מתחבר, שולח גרף שהוא בוחר ומתקבל את התשיבות על תוצאות כל האלגוריתמים על אותו กรף.

```
● parallels@ubuntu-linux-2404:~/Documents/PROJECT_OS/thread_server$ telnet localhost 9090
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^].
Welcome to the Multithreaded Algorithm Server!
-----
Please enter a request in the following format:
<vertices> <edges> <random_seed>
Example: 6 10 42
- vertices: number of nodes (> 0)
- edges: number of edges (>= 0)
- random_seed: integer for reproducibility
Type 'exit' or 'q' to quit.

> 8 8 8
Graph created successfully! Running algorithms...

[mst] Result:
Total MST weight (Prim's Algorithm): 5

[hamilton] Result:
No Hamiltonian Circuit exists.

[scc] Result:
SCC #1: 5
SCC #2: 2
SCC #3: 0 4 1 3 6 7

[maxclique] Result:
Maximum Clique Size: 3
Clique Members: 0 4 6

Thank you! Connection will now close.
```

כאן ניתן לראותו לטיפול בשגיאות - הליקוי מכניס קלט לא תקין כלומר שאינו תואם את מבנה הגרפף הרצוי.
השרת לאחר מכן שולח לו הודעה שגיאה ונונע לו הזמדנות נוספת להכניס קלט תקין.

```
○ parallels@ubuntu-linux-2404:~/Documents/PROJECT_OS/thread_server$ telnet localhost 9090
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Welcome to the Multithreaded Algorithm Server!
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Please enter a request in the following format:
<vertices> <edges> <random_seed>
Example: 6 10 42
- vertices: number of nodes (> 0)
- edges: number of edges (>= 0)
- random seed: integer for reproducibility
Type 'exit' or 'q' to quit.

> wrong input
Invalid input. Try again or type 'exit' to quit.
```

לבסוף מתבצעת בקשה של התנטקות ניתן לראות מה הליקוי ואת השרת:

```
> exit
Goodbye! Disconnecting...
Connection closed by foreign host.
○ parallels@ubuntu-linux-2404:~/Documents/PROJECT_OS/thread_server$ █

Random seed: integer for reproducibility,
Type 'exit' or 'q' to quit.

> q
Shutdown signal received. Server will terminate...
Connection closed by foreign host.
○ parallels@ubuntu-linux-2404:~/Documents/PROJECT_OS/thread_server$ █
```

דוחות :

- ניתן לראות שהשרת מקבל הודעה מתאימה על כל לקוח חדש שמתחבר/ מتنתק,
השרת תומר במספר חיבורים של לקוחות שונים במקביל (threads).

```
parallels@ubuntu-linux-2404:~/Documents/PROJECT_OS/thread_server$ valgrind --tool=helgrind ./thread_server
==298217== Helgrind, a thread error detector
==298217== Copyright (C) 2007-2017, and GNU GPL'd, by OpenWorks LLP et al.
==298217== Using Valgrind-3.22.0 and LibVEX; rerun with -h for copyright info
==298217== Command: ./thread_server
==298217==
Multithreaded Algorithm Server listening on port 9090...
[Client 1] Connected.
[Client 2] Connected.
[Client 3] Connected.
[Client 1] Graph received with 7 vertices and 7 edges.
[Client 1] Processing complete.
[Client 1] Connection closed.
[Client 2] Disconnected by request.
[Client 2] Connection closed.
[Client 3] Requested server shutdown.
==298217== ---Thread-Announcement---
==298217== Thread #4 was created
==298217== at 0x4C887B7: clone (clone.S:62)
==298217== by 0x4C254C7: create_thread (pthread_create.c:297)
==298217== by 0x4C25F97: pthead_create@GLIBC_2.34 (pthread_create.c:836)
==298217== by 0x48929BB: ??? (in /usr/libexec/valgrind/vgpreload_helgrind-arm64-linux.so)
==298217== by 0x49B1C67: std::thread:: M_start_thread(std::unique_ptr<std::thread::State, std::default_delet
e<std::thread::State> >, void (*)()) (in /usr/lib/aarch64-linux-gnu/libstdc++.so.6.0.33)
==298217== by 0x10DE07: std::thread::thread_void (ThreadServer::*)(int, ThreadServer*, int&, void>(void (Thr
eadServer::*&)(int), ThreadServer*&, int)) (std_thread.h:164)
==298217== by 0x10C927: ThreadServer::start() (ThreadServer.cpp:213)
==298217== by 0x10B5D3: main (main.cpp:7)
==298217==
==298217== ---Thread-Announcement---
==298217== Thread #1 is the program's root thread
==298217==
==298217== ---
==298217==
```



```
parallels@ubuntu-linux-2404:~/Documents/PROJECT_OS/thread_server$ make valgrind-memcheck
valgrind --leak-check=full --track-origins=yes ./thread_server
==257461== Memcheck, a memory error detector
==257461== Copyright (C) 2002-2022, and GNU GPL'd, by Julian Seward et al.
==257461== Using Valgrind-3.22.0 and LibVEX; rerun with -h for copyright info
==257461== Command: ./thread_server
==257461==
Multithreaded Algorithm Server listening on port 9090...
[Client 1] Connected.
[Client 1] Graph received with 8 vertices and 8 edges.
[Client 1] Processing complete.
[Client 1] Connection closed.
[Client 2] Connected.
[Client 3] Connected.
[Client 2] Graph received with 5 vertices and 5 edges.
[Client 2] Processing complete.
[Client 2] Connection closed.
[Client 3] Disconnected by request.
[Client 3] Connection closed.
[Client 4] Connected.
[Client 4] Requested server shutdown.

Server shut down gracefully.
[Client 4] Connection closed.
==257461==
==257461== HEAP SUMMARY:
==257461==     in use at exit: 0 bytes in 0 blocks
==257461==   total heap usage: 222 allocs, 222 frees, 125,110 bytes allocated
==257461==
==257461== All heap blocks were freed -- no leaks are possible
==257461==
==257461== For lists of detected and suppressed errors, rerun with: -s
==257461== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)
parallels@ubuntu-linux-2404:~/Documents/PROJECT_OS/thread_server$
```



```
==298217== Locks held: none
==298217== at 0x10D100: store (atomic_base.h:481)
==298217== by 0x10D100: std::atomic<bool>::store(bool, std::memory_order) (atomic:104)
==298217== by 0x10BA6F: ThreadServer::receiveGraph(int, int&, int) (ThreadServer.cpp:79)
==298217== by 0x10CDB8: ThreadServer::handleClient(int) (ThreadServer.cpp:132)
==298217== by 0x110D63: void std::__invoke_impl<void, void (ThreadServer::*)(int), ThreadServer*, int>(std::__
invoke memfun deref, void (ThreadServer::*&)(int), ThreadServer*&&, int&) (invoke.h:74)
==298217== by 0x110C53: std::__invoke_result<void (ThreadServer::*)(int), ThreadServer*, int>::type std::__in
voke<void (ThreadServer::*)(int), ThreadServer*, int>(void (ThreadServer::*&)(int), ThreadServer*&&, int&) (in
voke.h:96)
==298217== by 0x110B7F: void std::thread::Invoker<std::tuple<void (ThreadServer::*)(int), ThreadServer*, int
>:: M_invoke<0Ul, 1Ul, 2Ul>::operator()<std::tuple<void (ThreadServer::*)(int), ThreadServer*, int>::operator()
> (std::thread.h:292)
==298217== by 0x110B23: std::thread::Invoker<std::tuple<void (ThreadServer::*)(int), ThreadServer*, int>::operator()
>::operator() () (std::thread.h:299)
==298217== by 0x110B03: std::thread:: State impl<std::thread::Invoker<std::tuple<void (ThreadServer::*)(int),
ThreadServer*, int>:: M_run() (std::thread.h:244)
==298217== Address 0x138048 is 0 bytes inside data symbol "stop_flag"
==298217==

Server shut down gracefully.
==298217==
==298217== Use --history-level=approx or =none to gain increased speed, at
==298217== the cost of reduced accuracy of conflicting-access information
==298217== For lists of detected and suppressed errors, rerun with: -s
==298217== ERROR SUMMARY: 2 errors from 2 contexts (suppressed: 78 from 14)
parallels@ubuntu-linux-2404:~/Documents/PROJECT_OS/thread_server$
```

Valgrind Helgrind:

Incl.	Self	Distance	Calling	Callee
100.00	0.00	1	1	1 █ <code>__libc_start_main@@GLIBC_2.34</code> (<code>libc.so.6: libc-start.c</code>)
99.99	0.00	2	1	1 █ <cycle 17> (<code>libc.so.6</code>)
99.98	0.00	3	(0)	1 █ <code>__libc_start_main@@GLIBC_2.34'2</code> <cycle 17> (<code>libc.so.6: libc-start.c</code>)
99.98	0.00	4	1	1 █ (below main) (<code>libc.so.6: libc_start_call_main.h</code>)
99.97	0.00	5	1	1 █ <code>main</code> (<code>thread_server: main.cpp, ...</code>)
99.92	█ 66.54	7-10 (10)	3	1 █ <cycle 15> (<code>ld-linux-aarch64.so.1</code>)
98.97	0.00	6	1	1 █ <code>exit</code> (<code>libc.so.6: exit.c</code>)
98.97	0.00	7	1	1 █ <code>_run_exit_handlers</code> (<code>libc.so.6: exit.c</code>)
98.97	0.01	8	1	1 █ <cycle 16> (<code>libc.so.6</code>)
98.94	0.01	9	(0)	1 █ <code>_dl_fini</code> <cycle 16> (<code>ld-linux-aarch64.so.1: dl-fini.c, ...</code>)
25.69	█ 22.03	8-11 (11)	(0)	1 █ <code>fwrite'2</code> <cycle 15> (<code>libc.so.6: iofwrite.c, ...</code>)
16.23	█ 11.35	8-11 (11)	(0)	1 █ <code>_IO_file_xsputn@@GLIBC_2.17</code> <cycle 15> (<code>libc.so.6: libioP.h, ...</code>)
16.00	2.70	8-11 (11)	(0)	1 █ <code>do_lookup_x</code> <cycle 15> (<code>ld-linux-aarch64.so.1: dl-lookup.c</code>)
13.30	█ 11.00	9-12 (12)	1 061	1 █ <cycle 9> (<code>ld-linux-aarch64.so.1</code>)
12.31	█ 12.31	8-11 (11)	(0)	1 █ <code>_dl_lookup_symbol_x'2</code> <cycle 15> (<code>ld-linux-aarch64.so.1: dl-lookup.c, ...</code>)
7.66	7.64	10-13 (13)	(0)	1 █ <code>do_lookup_x'2</code> <cycle 9> (<code>ld-linux-aarch64.so.1: dl-lookup.c, ...</code>)
6.96	6.96	8-11 (11)	(0)	1 █ <code>gcov_do_dump.constprop.0'2</code> <cycle 15> (<code>thread_server</code>)
4.94	4.94	9-12 (12)	7 345	1 █ <code>__GI_memcpy</code> (<code>libc.so.6: memcpy.S</code>)