**שאלה 1**

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| **מאיצים חישוביים ומערכות מואצות**  **תרגיל רטוב 1** |
| גל גרנות 315681593 |
| שי תייר XXX |
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גרסת cuda:

$ nvcc --version

nvcc: NVIDIA (R) Cuda compiler driver

Copyright (c) 2005-2024 NVIDIA Corporation

Built on Wed\_Apr\_17\_19:19:55\_PDT\_2024

Cuda compilation tools, release 12.5, V12.5.40

Build cuda\_12.5.r12.5/compiler.34177558\_0

מספר GPU: 1

שאר פלט הפקודה:

$ nvidia-smi

Fri Jul 12 17:16:05 2024

+-----------------------------------------------------------------------------------------+

| NVIDIA-SMI 550.90.07 Driver Version: 550.90.07 CUDA Version: 12.4 |

|-----------------------------------------+------------------------+----------------------+

| GPU Name Persistence-M | Bus-Id Disp.A | Volatile Uncorr. ECC |

| Fan Temp Perf Pwr:Usage/Cap | Memory-Usage | GPU-Util Compute M. |

| | | MIG M. |

|=========================================+========================+======================|

| 0 NVIDIA GeForce RTX 2080 ... Off | 00000000:02:00.0 Off | N/A |

| 41% 60C P2 83W / 250W | 1913MiB / 8192MiB | 100% Default |

| | | N/A |

+-----------------------------------------+------------------------+----------------------+

| 1 NVIDIA GeForce RTX 2080 ... Off | 00000000:03:00.0 Off | N/A |

| 39% 56C P2 91W / 250W | 2827MiB / 8192MiB | 100% Default |

| | | N/A |

+-----------------------------------------+------------------------+----------------------+

| 2 NVIDIA GeForce RTX 2080 ... Off | 00000000:83:00.0 Off | N/A |

| 33% 49C P2 90W / 250W | 2689MiB / 8192MiB | 100% Default |

| | | N/A |

+-----------------------------------------+------------------------+----------------------+

| 3 NVIDIA GeForce RTX 2080 ... Off | 00000000:84:00.0 Off | N/A |

| 30% 29C P8 11W / 250W | 3MiB / 8192MiB | 0% Default |

| | | N/A |

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| Processes: |

| GPU GI CI PID Type Process name GPU Memory |

| ID ID Usage |

|=========================================================================================|

| 0 N/A N/A 1650410 C ./ex2 158MiB |

| 0 N/A N/A 1652257 C ./ex2 158MiB |

| 0 N/A N/A 1674146 C ./ex2 158MiB |

| 0 N/A N/A 1707496 C ./ex2 158MiB |

| 0 N/A N/A 1707943 C ./ex2 158MiB |

| 0 N/A N/A 1709402 C ./ex2 158MiB |

| 0 N/A N/A 1711557 C ./ex2 158MiB |

| 0 N/A N/A 1712790 C ./ex2 158MiB |

| 0 N/A N/A 1713517 C ./ex2 158MiB |

| 0 N/A N/A 1715156 C ./ex2 158MiB |

| 0 N/A N/A 1716030 C ./ex2 160MiB |

| 0 N/A N/A 1729169 C ./ex2 158MiB |

| 1 N/A N/A 1738528 C ./ex2 158MiB |

| 1 N/A N/A 1741563 C ./ex2 158MiB |

| 1 N/A N/A 1741944 C ./ex2 116MiB |

| 1 N/A N/A 1742370 C ./ex2 158MiB |

| 1 N/A N/A 1747091 C ./ex2 10MiB |

| 1 N/A N/A 1747146 C ./ex2 158MiB |

| 1 N/A N/A 1748603 C ./ex2 158MiB |

| 1 N/A N/A 1750195 C ./ex2 158MiB |

| 1 N/A N/A 1750757 C ./ex2 158MiB |

| 1 N/A N/A 1752521 C ./ex2 158MiB |

| 1 N/A N/A 1753950 C ./ex2 158MiB |

| 1 N/A N/A 1754681 C ./ex2 158MiB |

| 1 N/A N/A 1755917 C ./ex2 116MiB |

| 1 N/A N/A 1758453 C ./ex2 116MiB |

| 1 N/A N/A 1758859 C ./ex2 158MiB |

| 1 N/A N/A 1762626 C ./ex2 116MiB |

| 1 N/A N/A 1763022 C ./ex2 158MiB |

| 1 N/A N/A 1765296 C ./ex2 158MiB |

| 1 N/A N/A 1766532 C ./ex2 158MiB |

| 1 N/A N/A 1769213 C ./ex2 116MiB |

| 2 N/A N/A 383671 C /home/u\_208848499/homework1/ex1 136MiB |

| 2 N/A N/A 384817 C /home/u\_208848499/homework1/ex1 148MiB |

| 2 N/A N/A 444420 C /home/u\_208848499/homework1/ex1 148MiB |

| 2 N/A N/A 563586 C /home/u\_206902827/ex1 136MiB |

| 2 N/A N/A 1642481 C ./ex2 158MiB |

| 2 N/A N/A 1647044 C ./ex2 158MiB |

| 2 N/A N/A 1649084 C ./ex2 158MiB |

| 2 N/A N/A 1690430 C ./ex2 158MiB |

| 2 N/A N/A 1691523 C ./ex2 158MiB |

| 2 N/A N/A 1692714 C ./ex2 158MiB |

| 2 N/A N/A 1693888 C ./ex2 158MiB |

| 2 N/A N/A 1695432 C ./ex2 160MiB |

| 2 N/A N/A 1696257 C ./ex2 160MiB |

| 2 N/A N/A 1698222 C ./ex2 158MiB |

| 2 N/A N/A 1701085 C ./ex2 158MiB |

| 2 N/A N/A 1704751 C ./ex2 158MiB |

| 2 N/A N/A 1768240 C ./ex2 130MiB |

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$

פלט של ./deviceQuery:

$ ./deviceQuery

./deviceQuery Starting...

CUDA Device Query (Runtime API) version (CUDART static linking)

Detected 4 CUDA Capable device(s)

Device 0: "NVIDIA GeForce RTX 2080 SUPER"

CUDA Driver Version / Runtime Version 12.4 / 12.5

CUDA Capability Major/Minor version number: 7.5

Total amount of global memory: 7967 MBytes (8354398208 bytes)

(048) Multiprocessors, (064) CUDA Cores/MP: 3072 CUDA Cores

GPU Max Clock rate: 1815 MHz (1.81 GHz)

Memory Clock rate: 7751 Mhz

Memory Bus Width: 256-bit

L2 Cache Size: 4194304 bytes

Maximum Texture Dimension Size (x,y,z) 1D=(131072), 2D=(131072, 65536), 3D=(16384, 16384, 16384)

Maximum Layered 1D Texture Size, (num) layers 1D=(32768), 2048 layers

Maximum Layered 2D Texture Size, (num) layers 2D=(32768, 32768), 2048 layers

Total amount of constant memory: 65536 bytes

Total amount of shared memory per block: 49152 bytes

Total shared memory per multiprocessor: 65536 bytes

Total number of registers available per block: 65536

Warp size: 32

Maximum number of threads per multiprocessor: 1024

Maximum number of threads per block: 1024

Max dimension size of a thread block (x,y,z): (1024, 1024, 64)

Max dimension size of a grid size (x,y,z): (2147483647, 65535, 65535)

Maximum memory pitch: 2147483647 bytes

Texture alignment: 512 bytes

Concurrent copy and kernel execution: Yes with 3 copy engine(s)

Run time limit on kernels: No

Integrated GPU sharing Host Memory: No

Support host page-locked memory mapping: Yes

Alignment requirement for Surfaces: Yes

Device has ECC support: Disabled

Device supports Unified Addressing (UVA): Yes

Device supports Managed Memory: Yes

Device supports Compute Preemption: Yes

Supports Cooperative Kernel Launch: Yes

Supports MultiDevice Co-op Kernel Launch: Yes

Device PCI Domain ID / Bus ID / location ID: 0 / 2 / 0

Compute Mode:

< Default (multiple host threads can use ::cudaSetDevice() with device simultaneously) >

Device 1: "NVIDIA GeForce RTX 2080 SUPER"

CUDA Driver Version / Runtime Version 12.4 / 12.5

CUDA Capability Major/Minor version number: 7.5

Total amount of global memory: 7967 MBytes (8354398208 bytes)

(048) Multiprocessors, (064) CUDA Cores/MP: 3072 CUDA Cores

GPU Max Clock rate: 1815 MHz (1.81 GHz)

Memory Clock rate: 7751 Mhz

Memory Bus Width: 256-bit

L2 Cache Size: 4194304 bytes

Maximum Texture Dimension Size (x,y,z) 1D=(131072), 2D=(131072, 65536), 3D=(16384, 16384, 16384)

Maximum Layered 1D Texture Size, (num) layers 1D=(32768), 2048 layers

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Total amount of constant memory: 65536 bytes

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Total shared memory per multiprocessor: 65536 bytes

Total number of registers available per block: 65536

Warp size: 32

Maximum number of threads per multiprocessor: 1024

Maximum number of threads per block: 1024

Max dimension size of a thread block (x,y,z): (1024, 1024, 64)

Max dimension size of a grid size (x,y,z): (2147483647, 65535, 65535)

Maximum memory pitch: 2147483647 bytes

Texture alignment: 512 bytes

Concurrent copy and kernel execution: Yes with 3 copy engine(s)

Run time limit on kernels: No

Integrated GPU sharing Host Memory: No

Support host page-locked memory mapping: Yes

Alignment requirement for Surfaces: Yes

Device has ECC support: Disabled

Device supports Unified Addressing (UVA): Yes

Device supports Managed Memory: Yes

Device supports Compute Preemption: Yes

Supports Cooperative Kernel Launch: Yes

Supports MultiDevice Co-op Kernel Launch: Yes

Device PCI Domain ID / Bus ID / location ID: 0 / 3 / 0

Compute Mode:

< Default (multiple host threads can use ::cudaSetDevice() with device simultaneously) >

Device 2: "NVIDIA GeForce RTX 2080 SUPER"

CUDA Driver Version / Runtime Version 12.4 / 12.5

CUDA Capability Major/Minor version number: 7.5

Total amount of global memory: 7967 MBytes (8354398208 bytes)

(048) Multiprocessors, (064) CUDA Cores/MP: 3072 CUDA Cores

GPU Max Clock rate: 1815 MHz (1.81 GHz)

Memory Clock rate: 7751 Mhz

Memory Bus Width: 256-bit

L2 Cache Size: 4194304 bytes

Maximum Texture Dimension Size (x,y,z) 1D=(131072), 2D=(131072, 65536), 3D=(16384, 16384, 16384)

Maximum Layered 1D Texture Size, (num) layers 1D=(32768), 2048 layers

Maximum Layered 2D Texture Size, (num) layers 2D=(32768, 32768), 2048 layers

Total amount of constant memory: 65536 bytes

Total amount of shared memory per block: 49152 bytes

Total shared memory per multiprocessor: 65536 bytes

Total number of registers available per block: 65536

Warp size: 32

Maximum number of threads per multiprocessor: 1024

Maximum number of threads per block: 1024

Max dimension size of a thread block (x,y,z): (1024, 1024, 64)

Max dimension size of a grid size (x,y,z): (2147483647, 65535, 65535)

Maximum memory pitch: 2147483647 bytes

Texture alignment: 512 bytes

Concurrent copy and kernel execution: Yes with 3 copy engine(s)

Run time limit on kernels: No

Integrated GPU sharing Host Memory: No

Support host page-locked memory mapping: Yes

Alignment requirement for Surfaces: Yes

Device has ECC support: Disabled

Device supports Unified Addressing (UVA): Yes

Device supports Managed Memory: Yes

Device supports Compute Preemption: Yes

Supports Cooperative Kernel Launch: Yes

Supports MultiDevice Co-op Kernel Launch: Yes

Device PCI Domain ID / Bus ID / location ID: 0 / 131 / 0

Compute Mode:

< Default (multiple host threads can use ::cudaSetDevice() with device simultaneously) >

Device 3: "NVIDIA GeForce RTX 2080 SUPER"

CUDA Driver Version / Runtime Version 12.4 / 12.5

CUDA Capability Major/Minor version number: 7.5

Total amount of global memory: 7967 MBytes (8354398208 bytes)

(048) Multiprocessors, (064) CUDA Cores/MP: 3072 CUDA Cores

GPU Max Clock rate: 1815 MHz (1.81 GHz)

Memory Clock rate: 7751 Mhz

Memory Bus Width: 256-bit

L2 Cache Size: 4194304 bytes

Maximum Texture Dimension Size (x,y,z) 1D=(131072), 2D=(131072, 65536), 3D=(16384, 16384, 16384)

Maximum Layered 1D Texture Size, (num) layers 1D=(32768), 2048 layers

Maximum Layered 2D Texture Size, (num) layers 2D=(32768, 32768), 2048 layers

Total amount of constant memory: 65536 bytes

Total amount of shared memory per block: 49152 bytes

Total shared memory per multiprocessor: 65536 bytes

Total number of registers available per block: 65536

Warp size: 32

Maximum number of threads per multiprocessor: 1024

Maximum number of threads per block: 1024

Max dimension size of a thread block (x,y,z): (1024, 1024, 64)

Max dimension size of a grid size (x,y,z): (2147483647, 65535, 65535)

Maximum memory pitch: 2147483647 bytes

Texture alignment: 512 bytes

Concurrent copy and kernel execution: Yes with 3 copy engine(s)

Run time limit on kernels: No

Integrated GPU sharing Host Memory: No

Support host page-locked memory mapping: Yes

Alignment requirement for Surfaces: Yes

Device has ECC support: Disabled

Device supports Unified Addressing (UVA): Yes

Device supports Managed Memory: Yes

Device supports Compute Preemption: Yes

Supports Cooperative Kernel Launch: Yes

Supports MultiDevice Co-op Kernel Launch: Yes

Device PCI Domain ID / Bus ID / location ID: 0 / 132 / 0

Compute Mode:

< Default (multiple host threads can use ::cudaSetDevice() with device simultaneously) >

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU0) -> NVIDIA GeForce RTX 2080 SUPER (GPU1) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU0) -> NVIDIA GeForce RTX 2080 SUPER (GPU2) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU0) -> NVIDIA GeForce RTX 2080 SUPER (GPU3) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU1) -> NVIDIA GeForce RTX 2080 SUPER (GPU0) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU1) -> NVIDIA GeForce RTX 2080 SUPER (GPU2) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU1) -> NVIDIA GeForce RTX 2080 SUPER (GPU3) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU2) -> NVIDIA GeForce RTX 2080 SUPER (GPU0) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU2) -> NVIDIA GeForce RTX 2080 SUPER (GPU1) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU2) -> NVIDIA GeForce RTX 2080 SUPER (GPU3) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU3) -> NVIDIA GeForce RTX 2080 SUPER (GPU0) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU3) -> NVIDIA GeForce RTX 2080 SUPER (GPU1) : No

> Peer access from NVIDIA GeForce RTX 2080 SUPER (GPU3) -> NVIDIA GeForce RTX 2080 SUPER (GPU2) : No

deviceQuery, CUDA Driver = CUDART, CUDA Driver Version = 12.4, CUDA Runtime Version = 12.5, NumDevs = 4

Result = PASS