TASK B:

1. (seconds)

Threads/ICs	1024	2048	4096
1	16.68s	235.34s	2915.14s
2	7.25s	112.31s	1359.81s
4	3.57s	50.05s	582.86s
8	1.69s	30.25s	300.18s

2.

1 Thread/ICs	1024	2048	4096
Output Time	34.64s	397.47s	4486.49s
Calculated Time	34.55s	397.77s	4485.97s

cpu time = clock cycles / clock rate
1024: 128,196,721,125 / 3.701E9
2048: 1,583,113,408,481 / 3.98E9
4096: 17,145,397,950,957 / 3.822E9

3.

2 Thread/ICs	1024	2048	4096
Output Time	31.43s	330.90s	4828.47s
Calculated Time	31.44s	330.96s	4828.85s

cpu time = clock cycles / clock rate
1024: 124,266,360,325 / 3.952E9
2048: 1,308,622,502,953 / 3.954E9
4096: 18,011,626,900,937 / 3.73E9

The number of instructions are the same, this is because the number of threads does not impact the IC. Multiple threads indicate that the processor can execute multiple instructions at the same time. This does not change the instruction count.
https://whatsabyte.com/blog/processor-threads/

4.

Number of Threads	Problem Size	Execution Time

1	2048	235.94s
2	2048	100.57s
4	2048	48.44s

Speedup = old exec time / new exec time
Speedup = 235.94 / 48.44
Speedup = 4.87

5. (2048 problem size)

Number of Threads	GFLOPs/sec	Execution Time
1	0.2204	390.03s
2	0.5131	167.51s
4	0.6982	123.12s

Theoretical Max GFLOPs/sec from Task_A = 337.7
1: 0.2204 / 337.7 = 0.06%
2: 0.5131 / 337.7 = 0.15% -- of max theoretical computational power
4: 0.6982 / 337.7 = 0.21%

6.

Number of Threads	Problem Size	Compile Flag	CPU Time	CPI
8	2048	-g	43.07s	1.18cpi
8	2048	-O0	42.97s	1.17cpi
8	2048	-O1	25.02s	2.84cpi
8	2048	-O2	25.31s	2.86cpi
8	2048	-O3	25.20s	2.85cpi

7. Performance options like the optimization can change how code performs. It changes the semantics and forces the compiler to make assumptions of exactly what source code is doing, so these options are turned off by default. There are levels of optimizations so that the programmer can decide to what extent he wants the optimization to impact their code.

https://docs.oracle.com/cd/E19059-01/stud.9/817-6694/9_perform.html#:~:text=Performance%20options%20are%20normally%20off,about%20a%20user's%20source%20code.&text=If%20numerical%20results%20change%2C%20the,analysis%20to%20locate%20and%20reprogram.