5. (10) Find the current listing (17 th) for the Green500 list for 2021. Review the system architecture for each of the top 10 systems on this list. Discuss the differences that you see from this list and the list for the Top500 you found in question 4. *Answers to this question should be included in your homework 1 write-up in pdf format.

- The major sources of on-chip power consumption of circuit-level components are clock tree, registers, control, and data path logic circuitry and memory. Some of the other minor factors that contribute to power consumption are logic style, logic design, cell and wire sizing, floor planning, placement, and technology mapping. However, the on-chip power consumption factors are:

    - Transistor density
    - Voltage
    - Clock frequency
    - Die size
    - Cache size
    - Process technology and Process variation
    - Number of cores
    - Number of threads and
    - Micro-architecture

Green500 Top 10 supercomputers Summary:

S.No	Name	Number of cores	Memory	Number of GPUs, Type	Processor	Interconnect
1	MN-3	1,664	110,592 GB	0	Xeon Platinum 8260M 24C 2.4GHz	MN-Core DirectConnect
2	Hipergator AI	138,880	280,000 GB	1120 Nvidia A100	AMD EPYC 7742 64C 2.25GHz	Infiniband HDR
3	Wilkes-3	44,800	81,920 GB	320 Nvidia A100	AMD EPYC 7763 64C 2.45GHz	Infiniband HDR200 dual

4	Meluxina	99,200	102,400 GB	800 Nvidia A100	AMD EPYC 7452 32C 2.35GHz	Mellanox HDR InfiniBand/ParTec ParaStation ClusterSuite
5	Nvidia Dgx Superpod	19,840	40,000 GB	1536 Nvidia A100	AMD EPYC 7742 64C 2.25GHz	Mellanox HDR Infiniband
6	Perlmutter	706,304	390,176 GB	6000 Nvidia A100	AMD EPYC 7763 64C 2.45GHz	Slingshot-10
7	Juwels booster	449,280	628,992 GB	3744 Nvidia A100	AMD EPYC 7402 24C 2.8GHz	Mellanox HDR InfiniBand
8	Jureca	105,840	96,768 GB	768 Nvidia A100	AMD EPYC 7742 64C 2.25GHz	Mellanox HDR InfiniBand
9	Spartan	23,040	32,256 GB	0	AMD EPYC 7402 24C 2.8GHz	Mellanox HDR Infiniband
10	Wisteria	42,120	23,040 GB	360 Nvidia A100	Xeon Platinum 8360Y 36C 2.4GHz	Infiniband HDR

Top500 Top 10 supercomputers Summary:

S.No	Name	Number of cores	Memory	Number of GPUs, Type	Processor	Interconnect
1	Fugaku	7,630,848	5,087,232 GB	0	A64FX 48C	Tofu

					2.2GHz	interconnect D
2	Summit	2,414,592	2,801,664 GB	27,648 Tesla V100	IBM POWER9 22C 3.07GHz	Dual-rail Mellanox EDR Infiniband
3	Sierra	1,572,480	1,382,400 GB	17,280 Tesla V100	IBM POWER9 22C 3.1GHz	Dual-rail Mellanox EDR Infiniband
4	Sunway	10,649,600	1,310,720 GB	0	Sunway SW26010 260C 1.45GHz	Sunway
5	Perlmutter	706,304	390,176 GB	6000 Nvidia A100	AMD EPYC 7763 64C 2.45GHz	Slingshot-10
6	Selene	555,520	1,120,000 GB	4,480 Nvidia A100	AMD EPYC 7742 64C 2.25GHz	Mellanox HDR Infiniband
7	Tianhe - 2A	4,981,760	2,277,376 GB	35,584 Matrix-2000	Intel Xeon E5-2692v2 12C 2.2GHz	TH Express-2
8	Juwels booster	449,280	628,992 GB	3,744 Nvidia A100	AMD EPYC 7402 24C 2.8GHz	Mellanox HDR InfiniBand
9	HPC5	669,760	349,440 GB	7,280 Tesla V100	Xeon Gold 6252 24C 2.1GHz	Mellanox HDR Infiniband
10	frontera	448,448	1,537,536 GB	0	Xeon Platinum 8280 28C 2.7GHz	Mellanox InfiniBand HDR

After reviewing the Green500 list and comparing it with the Top500 list, I found the following differences,

1. Architectural differences, especially choice of processor, can make a big difference with regards to power. Eight supercomputers from the Green500 top 10 list have a variant of AMD EPYC as their processor as opposed to two supercomputers in the TOP500 top 10 list.
2. The number of cores is significantly lower in the Green500 list compared to the Top500 list. The most power efficient supercomputer MN-3 has only 1664 cores which is around 0.02% of the number of cores in the topmost supercomputer in the Top500 list.
3. The clock frequency is also lower in the Green500 list compared to the Top500 list.Usually higher the clock frequency, higher the power consumption.
4. The memory for the supercomputers in the Green500 list is around 10 times lower than that of the supercomputers in the TOP500 top 10 list.
5. The number of GPUs for the supercomputers in the Green500 list is significantly lower than that of the supercomputers in the TOP500 top 10 list.