1.

Sol)
Seek time + rotation delay = 5 + 4 = 9 msec
Average file size = 8×2^{10} Byte = 2^{13} Byte,
Transfer rate = 8MB/sec = 8×2^{20} Byte/sec = 2^{23} Byte/sec
A file with average size can transfer 9 + (2^{13} Byte /2^{23} Byte/sec)$\times 10^3$ = 9.977 msec
Read + write takes 9.977 + 9.977 = 19.954 msec

8KB takes 19.1954 msec
8GB space take 19.954 $\times 2^{20}$ mec = 20923285.504 msec = 20923.285504 sec = 5.8 hour

2.

Sol) since 1 block is 2KB, and 4 Byte per block address, it can save $2 \times 2^{10} / 4 = 2^9 = 512$ block information
Total = 512 + 10 = 522 block information.
Since a block size is 2KB, largest file will be 2KB × 522 =1044 KB

3.

a.

128 GB = 128GB / 8KB blocks = $128 \times 2^{30} / 8 \times 2^{10} = 2^7 \times 2^{30} / 2^3 \times 2^{10} = 2^{37} / 2^{13} = 2^{24}$ blocks
Each block can save $2^{16}/64 = 2^{10}$-1 = 1023 block information.
2^{24} blocks /1023 = 16400.1

b.

128 GB =2^{24} blocks
Need 2^{24} bits= $2^{24} / 8 = 2^{24} / 2^3 = 2^{21}$ Byte
Need $2^{21} / (8 \times 2^{10}) = 2^8$ blocks for saving free block information

c.

- Since this system use 64 bit disk block number, this system support 2^{64} blocks
- Maximum disk size = $2^{64} \times 8 \times 2^{10}$ Byte =128×2^{70} = 128 ZB

4.

Sol)

Since there are B blocks, system with bit map need B bits space to keep free block information.
At time t, if there is F free blocks, system with free-list need DF bits space for free block information.
Free list need less space than bit map if DF <B ---(A)

Fraction of free blocks = number of free block / total number of block = F /B
From A) we can get F/B < 1/D. if D is 16, than 1/16 = 0.0625. about 6 % of disk space must be free.