1. avgRD = (maxRD + minRD) / 2

   But, we know the minimum rotational delay is when the stored data happens to be at the location of the relay head. So, minRD = 0 ms.

   The maximum rotational delay is one full rotation. Converting 15,000 rpm -> rotations per milliseconds = (60)(1000)/(15000) = 4 ms per rotation.

   Thus, avgRD = (0 + 4) / 2 = 2 ms

2. Since a record has 64 bytes and each sector holds 512 bytes, there are (512/64) = 8 records per sector

3. There are 8 sectors per cluster and 400 sectors per track. Then, there are 50 clusters per track.

   The total number of tracks = (64)(20000) / (400)(512) = 6.25 tracks

   Thus, there are (50) * (6.25) = 312.5 clusters needed for the file.

   313 clusters is INCORRECT!, but OK! Because NOT LOSING DATA!

4. Total time for reading one track = (seek time) + (avgRD) + (transfer time)

   = (6 ms) + (2 ms) + (4 ms)

   = 12 ms

   Seek Time = 6 ms (given)

   avgRD = 2 ms (calculated from problem 1)

   Transfer Time = 4 ms (calculated from problem 1)

5. Total time for reading whole file = (total time per track) * (# of tracks) = (6.25) * (12) = 75 ms

   Firstly, (6) * (12) = 72 ms.

   For the rest of the track, 0.25, it takes 6 ms (seek time) + 2 ms (avgRD) + 1 ms (transfer time for a quarter of a track) = 9 ms

   THEREFORE, 72 + 9 = 81 ms for the Total Time for Reading Whole File

6. Time for reading one cluster = (# sectors per cluster) * (transfer time / # of sectors per track)

   = (8) * (4 / 400) = 0.08 ms

Seek Time = 6 ms (given)

avgRD = 2 ms (calculated from problem 1)

Transfer Time = 4 ms (calculated from problem 1)

7. Total time for reading the whole file with respect to random storage of the records

= (# of records) * (time per record)

But, the time per record = (seek time) + (avgRD) + (time reading one cluster)

= (6) + (2) + (0.08) = 8.08 ms

Thus, the total time for reading the whole file = (20,000) * (8.08) = 161,600 ms or 161.6 s or 2.69 min