1. Which feature of UNIX made it portable? (10 points)

   It was written in a high-level language.

2. What are UNIX soft links? (10 points)

   UNIX soft links are special entities within the file system that point to other files, much like Windows shortcuts. (They are also called symbolic links.)

   What is the main reason for having them? (10 points)

   They can cross disk partition boundaries, which other links cannot cross.

3. What was the main advantage of the VMS page replacement policy over that of Berkeley UNIX? (10 points)

   It supported real-time processes because it could allocate a specific number of page frames to any

   process.

4. Why did Babaoğlu and Joy decide not to use the Sampled Working Set page replacement policy for their implementation of UNIX? (10 points)

   The Sampled Working Set page replacement policy required resetting the page referenced bit of all

   page frames of a process every T milliseconds. Since Babaoğlu and Joy had to simulate that operation

   by marking page frames as invalid, this would have caused too many context switches.

Total: _____/50
5. Recall that FFS i-nodes have a fifteenth block address that is never used. Assuming a block size of 8 KB,
   a) What would we gain by using this fifteenth block address to store one extra direct block address?
      (10 points)

      We would be able to access eight extra kilobytes directly from the i-node.

   b) What would we gain by using this fifteenth block address to store a second single indirect block address?
      (10 points)

      We would be able to access sixteen extra megabytes with one level indirection, thus doubling the
      number of blocks that could be accessed that way.

   c) Which of these two options would you recommend and why? (10 points)

      Doubling the number of blocks that can be accessed with one level of indirection is more important
      than allowing direct access to 8 extra kilobytes.

6. Consider a proposed variant of the UNIX system that would combine the UNIX fork( ) and exec( ) into a
   single system call like MS Windows CreateProcess( ).
   a) What would be the main advantage of this approach? (10 easy points)

      In addition to eliminating two context switches, we would eliminate the wasteful practice of copying
      the contents of the parent process address space into the child process address space.

   b) Which UNIX features would have to be completely reimplemented? (10 less obvious points)

      Pipes and all kinds of I/O redirection would have to be completely reimplemented because the
      parent program would lose the access lose control to the child process from the moment the child
      process is created.
1. Consider a proposed variant of the UNIX system that would combine the UNIX `fork()` and `exec()` into a single system call like MS Windows `CreateProcess()`.

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   Pipes and all kinds of I/O redirection would have to be completely reimplemented because the parent program would lose the access lose control to the child process from the moment the child process is created.

2. Which feature of UNIX made it portable? (10 points)

   It was written in a high-level language.

3. What was the main advantage of the VMS page replacement policy over that of Berkeley UNIX? (10 points)

   It supported real-time processes because it could allocate a specific number of page frames to any process.

4. Why did Babaoğlu and Joy decide not to use the VMS page replacement policy for their implementation of UNIX? (10 points)

   It was too difficult to ascertain the right number of page frames to allocate to any given process.

Total: _____/50
5. Recall that FFS i-nodes have a fifteenth block address that is never used. Assuming a block size of 4 KB,
   a) What would we gain by using this fifteenth block address to store one extra direct block address?
      (10 points)
      
      We would be able to access four extra kilobytes directly from the i-node.

   b) What would we gain by using this fifteenth block address to store a second single indirect block address?
      (10 points)
      
      We would be able to access four extra megabytes of file space with one level of indirection, thus
      doubling the number of blocks that could be accessed that way.

   c) Which of these two options would you recommend and why? (10 points)
      
      Doubling the number of blocks that can be accessed with one level of indirection is more important
      than allowing direct access to four extra kilobytes.

6. What are *UNIX special files*? (10 points)
   
   UNIX special files are not files but physical storage devices, such as floppy drives, flash drives and so
   on.
   
   What is the main reason for having them? (10 points)
   
   Giving file names to these devices allows programmers to access these devices as if they were regular
   files.