



1. Determine the decimal value of the following numbers. (6%)
 a) 133 (base 4); b) 367 (base 8); c) 1BA (base 16);
2. If a computer uses 18 bits to represent integer values, what is the largest unsigned value that can be represented? (4%)
3. Assume that our computer stores decimal numbers using 16 bits – 10 bits for a sign/magnitude *mantissa* and 6 bits for a sign/magnitude base-2 *exponent*. Show the internal representation of the following decimal quantities.
 a) +7.5; b) -20.25; c) -1/64. (6%)
4. How many selector lines would be needed on a four-input multiplexor? On an eight-input multiplexor? (4%)
5. Consider the following program segment, where i , j , and k are integer variables. How many times is the print statement executed in this program segment? (10%)


```

for  $i := 1$  to 20 do
  for  $j := 1$  to  $i$  do
    for  $k := 1$  to  $j$  do
      print ( $i * j + k$ )
      
```
6. A file's attributes vary from one operating system to another. Please list typical OS attributes. (10%)
7. A typical floppy disk on a PC has the following characteristics: (10%)
 - Rotation speed = 7200 rev/min
 - Arm movement time = 1 msec fixed startup time + 0.1 msec for each track crossed (The 1 msec time is a constant no matter how far the arm moves.)
 - Number of surfaces = 2 (a **double-sided** floppy disk. A single read/write arm holds both read/write heads.)
 - Number of tracks per surface = 100
 - Number of sectors per track = 20
 - Number of characters per sector = 512
 - Assume that, on average, the read-write head must move about 30 tracks.
 (a) How many characters can be stored on a single floppy disk?
 (b) What are the best-case, worst-case, and average-case access times for this disk?
8. For a computer that has 64MB (megabytes) of memory, how many bits does the computer need to address any single byte in memory? (10%)
9. Suppose we have a computer system that uses ASCII Code to represent characters. The size of each ASCII code is one byte. How many bytes of memory does the



computer need to store a full screen of data if the screen is made of 25 lines with 80 characters in each line? (10%)

10. Suppose we have a cache with 2048 blocks and a 32-bit address. The size of each block is 16 bytes. The cache is direct mapped. What is the size of the offset field in the 32-bit address? (5%) What is the size of the tag field in the 32-bit address? (5%)
11. Suppose we need to sum 64,000 numbers on a shared memory multiprocessor computer with uniform memory access time. Let's assume we have 64 processors. Here is the parallel processing program, written in C code, executed on 64 processors. Pn is the number that identifies the processors, between 0 and 63.

```

sum[Pn] = 0;
for (i = 1000*Pn; i < 1000*(Pn+1); i = i + 1)
    sum[Pn] = sum[Pn] + A[i] ;
half = 64;
do
    synch();
    if (half%2 != 0 && Pn == 0) sum[0] = sum[0] + sum[half-1];
    half = half/2;
    if (Pn < half) sum[Pn] = sum[Pn] + sum[Pn+half];
while (half > 1);
  
```

- (a) What is the purpose of `synch()`? (5%)
- (b) For each processor, how many times will the “do – while” loop be executed? (5%)
- (c) For the 64th processor ($P_n = 63$), how many times will the statement “`sum[Pn] = sum[Pn] + sum[Pn+half]`” be executed? (5%)
12. What were the two major motivations for virtual memory? (複選題，全對才給分) (5%)
- (a) To allow efficient and safe sharing of memory among multiple programs.
- (b) To remove the programming burden of a small, limited amount of main memory.
- (c) To predict the presence and creation of faults, allowing the component to be replaced before it fails.
- (d) To reduce the miss rate of a cache.