

考 試 科 目	計 算 機 結 構		<input checked="" type="checkbox"/> 大學日間 <input type="checkbox"/> 大學進學 <input type="checkbox"/> 碩士班 <input type="checkbox"/> 碩士在職班		資 訊 工 程 學 系 3 年 B 班	命 題 老 師	林 熙 中
考 試 日 期	12 月 28 日 星 期 五 第 2~4 節		附 答 案 紙 <input type="checkbox"/> 是 <input checked="" type="checkbox"/> 否 列 印 大 小 <input checked="" type="checkbox"/> A4 <input type="checkbox"/> B4		試 卷 別 <input checked="" type="checkbox"/> 單 一 <input type="checkbox"/> A 卷 <input type="checkbox"/> B 卷	印 刷 份 數	60
姓 名		學 號				序 號	

1. To enhance data reliability, a memory system uses Hamming error correction code to detect and correct one bit-error. (16 points)

- (a) Suppose 1010101 is the word to be written into memory. What is the resulting bit-string stored in memory.
- (b) Now consider the read operation of the memory system. What is the correct data word embedded in the bit-string 00110001100 retrieved from memory? Will any error be detected during this read operation?

2. By adding one extra parity bit, Hamming error correction code is capable of detecting a double-bit error and correcting a single-bit error. (For simplicity, assume that the extra parity bit is placed as the left-most bit.)

- (a) Suppose 1010101 is the word to be written into memory. What is the resulting bit-string stored in memory.
- (b) Now consider the read operation of the memory system. What is the correct data word embedded in the bit-string 000110001100 retrieved from memory? Will any error be detected during this read operation?

(8 points)

3. Answer the following questions concisely and precisely?

(8 points)

- (a) Explain the technique of “CAV” used in magnetic disks. What are the main advantage and disadvantage.
- (b) Explain the technique of “CLV” used in optical disks. What are the main advantage and disadvantage.

4. Consider a magnetic disk drive with 4 surfaces, 256 tracks per surface, and 128 sectors per track. Sector size is 1KB and the drive rotates at 3000rpm. Its average seek time is 4ms, while track-to-track access time is 2ms. Successive tracks in a cylinder can be read in turn without heads movement and additional rotational delay, but can not be read simultaneously. (20 points)

- (a) What is the disk capacity?
- (b) What is the average access time?
- (c) Estimate the time required to transfer a 800KB file which is optimally organized.
- (d) Estimate the time required to transfer a 800KB file where sectors are distributed randomly over the disk.
- (e) What is burst transfer rate (the highest speed at which data can be transferred)?

5. Find the sum of 01111001 and 00010111 assuming numbers are represented in

(8 points)

- (a) sign-magnitude representation;
- (b) twos complement.

(a)

(b)

6. How to extend the bit length of an integer in twos complement representation? Explain why it works. (8 points)

7. Given $x = 10011$ and $y = 11101$ in twos complement notation, do the following arithmetic.

(a) $x - y$. (4 points)

(b) $x \times y$. (Use the Booth algorithm and you should describe how registers are changed.) (8 points)

(c) x / y . (Use the algorithm described in Sect.10.3 and describe how registers are changed.) (8 points)

(a) $x - y$.

(b) $x \times y$.

(c) x / y .

8. Consider a reduced 16-bit floating point format, where the left most bit is a sign bit, the following 9 bits represent the exponent and the other 6 bits at the right-hand side are for the significand. For simplicity, we assume that values are normalized and the exponent is coded in biased representation. Please answer the following questions. (16 points)

- (a) Express $(-121/16)_{10}$ in this format.
- (b) What is the equivalent decimal value for $(1100\ 0011\ 0011\ 1100)_2$?
- (c) What is the smallest positive number (in decimal) that can be coded with this format?
- (d) What is the smallest number (in decimal) that can be coded with this format?