考　試　科　目	計算機概論	所　別	數位內容碩士學位學程 資訊技術組　5152	考　試　時　間	2 月 22 日（六）第三節

1. Explain the following technologies / terms and their influence on current digital content related implementations:（20%）
　　1) Folksonomy
　　2) Digital Rights Management
　　3) Digital Publishing
　　4) Big Data

2. Elaborate your experience and observation about recent digital content applications on mobile devices? (10%)

3. Describe your knowledge about digital archives and the potential usages of those collected digital contents. (10%)

4. What is Multimedia Data Mining? Can you give some examples on current digital content related applications that utilize Multimedia Data Mining technology? Can you explain their technical details? (10%)

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5. **[Analog to Digital Conversion]** Sampling and quantization are two processes to convert an analog signal into its digital representation. (1) State the Nyquist-Shannon sampling theorem. (5%) (2) Illustrate rounding quantization with a simple example. (5%)

6. **[Video Compression]** In motion-compensation-based video compression algorithms, each image is divided into *macroblocks* of size NxN. After the first frame, only the motion vectors and difference macroblocks need be coded. The following pseudo-code demonstrates a sequential search process for motion vectors:

Note: MAD (Mean absolute difference) is defined as:

$$MAD(i,j) = \frac{1}{N^2}\sum_{k=0}^{N-1}\sum_{l=0}^{N-1}|C(x+k,y+l) - R(x+i+k,y+j+l)|$$

where $C(x+k,y+l)$ are the pixels in the macroblock in the Target (current) frame and $R(x+i+k,y+j+l)$ are the pixels in the macroblock in the Reference frame.

```
Procedure Motion-vector MV: sequential search
BEGIN
min_MAD=LARGE_NUMBER;   /*Initialization */
for i=-p to p
   for j=-p to p
   {
      current_MAD=MAD(i,j);
      if current_MAD < min_MAD
      {
         min_MAD= current_MAD;
         u = i;  /*Get the coordinates for MV */
         v= j ;
      }
   }
END
```

(1) Show that the complexity for the sequential search for a **single** macroblock is $O(p^2N^2)$. (5%)

(2) Assume that p=15 and N=16. Compute the <u>total number of operations</u> needed per second to estimate the motion vectors for a video of resolution 720x480 and 30 frames per second. (5%)

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7. **[Number system]** A base-3 representation has three digits: 0, 1, 2.

   (1) Convert 1201_3 into its equivalent binary representation. (2%)

   (2) How many bits are required to store a five-ternary-digit number? (2%)

   (3) Use the binary-coded-ternary representation (i.e., 0→00, 1→01, 2→10) to encode 1201_3. How many bits are required to store a length N ternary number using binary-coded-ternary representation? (4%)

   (4) Design a logic circuit to compute the Hamming distance between two binary-encoded ternary digits. (2%)

8. **[Multimedia Communication]** Illustrate the concepts of unicast, multicast, and broadcast with simple drawings. (10%)

9. **[QoS]** (1) IP networks are often described as 'best-effort' networks. Why? (3%) (2) What does 'QoS' stand for? (3%) (3) Explain packet jitter in computer networks. (4%)