

**PRINCE OF SONGKLA UNIVERSITY  
FACULTY OF ENGINEERING**

Final Examination: Semester I  
Date: 07 October 2007  
Subject: 240- 534 Advanced Computer Engineering  
Design and Systems

Academic Year: 2007  
Time: 13:30 – 15:30  
Room: A400

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Instructions:

1. Answer all 3 design questions. ( 80 marks in totals).
2. Write your answer in the answer book.
3. You have 2 hours to complete the examination.

1. Design the systems (Logic level design) using distributed arithmetic (DA) structure to compute this following equation:  $y = \sum_{n=0}^{N-1} c[n]x[n]$ .

(20 marks)

2. Design the systems (Logic level design) to calculate halftone pixel based on these following algorithm given in C.

(20 marks)

```
for (k=1; k<N; k++) { Err[k][0] = 0; } // initial boundary

for (k=0; k<=M; k++) {Err[0][k] = 0; } Err[N+1][0] = 0;

for (j=1; j<M; j++) { // iterate over rows
    for (i=1; i<N; i++) { // iterate over col
        E_av = (7*e[i-1][j] + 1*e[i-1][j-1] + 5*e[i][j-1] + 3*e[i+1][j-1]) / 16;
        CPV = PV[i][j] + E_av;
        CPV_round = (if CPV < T then 0 else 255); // Threshold = 128
        HTPV[i][j] = if (
            CPV_round==0 then 0 else 1);
        e[i][j] = CPV - CPV_round;
    }
}
```

3. Redesign your system using design techniques to improve the performance of the system in question 2.

3.1 pipelining (20 marks)

3.2 parallelism (20 marks)

All documents and calculator are allowed.