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INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech I Semester End Examinations (Regular) - February, 2017

Regulation: IARE-R16

HIGH PERFORMANCE ARCHITECTURE

(Computer Science and Engineering)

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

1. (a) Illustrate the primary compiler problem for vector pipelined machines. [8M]
 (b) What is Bernstein's condition? Given an example of loop that violates the third Bernstein Condition. [6M]
2. (a) Dependences represent two kinds of constraints on program transformations- What are they? Give an example for each. [6M]
 (b) Movement of statements must be prohibited from their original iteration vectors to avoid transformations – Justify with a suitable example. [8M]

UNIT – II

3. (a) Test for dependences on S. Write down the subscripts. Which positions are separable, which are coupled? Which dependence test would you apply to each position? [7M]
 - i.


```

          for (k=0; k<100; k++) {
            for (j=0; j<100; j++) {
              for (i=0; i<100; i++) {
                S      A[i+1,j+1,k+1] = A[i,j,1] + c;
              }
            }
          }
          
```
 - ii.


```

          for (k=0; k<100; k++) {
            for (j=0; j<100; j++) {
              for (i=0; i<100; i++) {
                S      A[i+1,j+k+1,i] = A[i,j,2] + c;
              }
            }
          }
          
```
- (b) Outline the Subscript Partitioning Algorithm [7M]

4. (a) Construct valid breaking conditions for the following [8M]
 for (k=0; k<100; k++) {
 for (j=0; j<100; j++) {
 for (i=0; i<100; i++) {
 S A[i+1,j+1,k+1] = A[i,jx,1] + c;
 }
 }
 }
 }
 (b) Explain briefly delta test for coupled groups with a suitable example. [6M]

UNIT – III

5. (a) Discuss legality of loop interchange with a suitable example. [10M]
 (b) Consider the following code [4M]
 DO I = 1, 100
 S1 T = A(I) + B(I)
 S2 C(I) = T + T
 S3 T = D(I) - B(I)
 S4 A(I+1) = T * T
 ENDDO
 What will be the effect of renaming the scalar T
6. (a) What is loop alignment? Explain with a suitable example. [7M]
 (b) Consider the following loop-nest [7M]
 for i = 1:100 {
 for j = 1:100 {
 S1 A(i,j) = B(i,j) + C(i,j);
 S2 D(i,j) = A(i-1,j-1)*2.0;
 }
 }
 }
 Can loop interchange be used here to parallelize or vectorize the loop.

UNIT – IV

7. (a) In general, backward branches are complicated – Justify [7M]
 (b) Outline the procedure for Strip Mine and Interchange. [7M]
8. (a) Exit branches are more complicated to eliminate than are forward branches – Comment. [6M]
 (b) Illustrate how Simple Blocking algorithm performs on the inner loop of matrix multiplication after loop interchange: [8M]
 DO J = 1, N
 DO K = 1, N
 DO I = 1, N
 C(I,J) = C(I,J) + A(I,K) * B(K,J)
 ENDDO
 ENDDO
 ENDDO

UNIT – V

9. (a) Explain how different types of dependences can affect memory hierarchy management. [8M]

(b) Consider the following code [6M]

```
DO I = 1, N
  DO J = 1, N
    C(J,I) = 0.0
    DO K = 1, N
      C(J,I) = C(J,I) + A(J,K) * B(K,I)
    ENDDO
  ENDDO
ENDDO
```

What is the effect of using unroll-and-jam with a factor of 2 to each of the outer loops?

10. (a) Bring out the three-phase for pruning edges. [9M]

(b) What is the impact of loop order on register reuse? [5M]