INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

Code No: **BCS003**

MODEL QUESTION PAPER - II

M. Tech I Semester

HIGH PERFORMANCE ARCHITECHTURE

(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 classification of dependences with loop graphs and discuss about level of loop carried dependence. [7M]

   (b) List out preliminary transformations required to make dependence testing more accurate loop normalization. If there is a loop carried dependence, then that loop cannot be parallelized. Justify? [7M]

2. (a) What needs to be true for a loop to be parallelizable? Can different processors run different iterations in parallel? [8M]

   (b) Iteration reads/writes allocation that a later iteration writes, and then what type of Dependences occurs. [6M]

UNIT - II

3. (a) Dependencies exist between two subscripted references to the same array in aloop nest mention the several tests to detect these dependencies. Explain them in detail. [7M]

   (b)
   ```
   DO i1 = L1, U1
   DO i2 = L2, U2 ...
   DO in = Ln, Un
   S1        A(f1(i1,...,in),...,fm(i1,...,in)) = ...
   S2        ... = A(g1(i1,...,in),...,gm(i1,...,in))
   ENDDO ...
   ENDDO
   ENDDO
   ```
   State the rules when the dependence exists between the S1 and S2.Explain subscript Partitioning. [7M]

4. (a) Define the term index. If a subscript has indices and do not occur in other subscript. Then subscript is knows as? Consider the following expression A(i+1,j) =A(k, j)+C. Mention whether the subscripts are separable or not. If subscripts are separable which test is applied? [7M]

   (b) Define the term subscript. If two different subscripts contain the same index then that subscript is knows as?
   Consider the following expression A(1,j,j)=A(1,j,k)+C. List the coupled subscripts and state which test is Applied for coupled subscripts. [7M]

UNIT - III

5. (a) Codegen tries to find parallelism using transformations of loop distribution and statement reordering codegen will not uncover any vector operations. Explain how this problem can be rectified by scalar expansion. [7M]

   (b) Discuss enhancing coarse grained parallelism using privatization and scalar Expansion. Distinguish between fine grained parallelism and coarse grained parallelism. [7M]

6. (a) Let D(i,j) be a direction vector for a dependence in a perfect nest of n loops. Then the direction vector for the same dependence after a permutation of the loops in the nest is determined by applying the same permutation to the elements of D(i,j). Exemplify the above theorem. [7M]

   (b) One of the drawbacks of scalar expansion is increases memory requirements. State solutions to prevent this drawback. [7M]

UNIT IV

7. (a) Describe how loop unroll-and-jam is used in conjunction with scalar replacement to lower the balance of a memory-bound loop. [7M]

   (b) Distinguish between the write-through and write-back policies pointing out their merits and demerits? [7M]

8. (a) Identify how register allocation plays a vital role in compiler optimization and list the types of cache blocking. [7M]

   (b) A two way set Associative cache memory uses blocks of four words. The cache can accommodate a total of 2048 words from main memory. The main memory size is 128**K** X 32

   I. Formulate all pertinent information required to construct the cache memory

   II. What is the size of cache memory?

   [7M]

UNIT - V

9. (a) Discuss dependences Spanning Multiple iterations and if there are scalar copies in the loop. Write a procedure to eliminate the scalar copies in iterations. [7M]

   (b) Identify how data dependence is calculated if registers are reused and how can we improve register reuse in loop carried and loop independent. [7M]

10. (a) Discuss in detail about how data dependence is calculated when the loops are independent reuse and loop carried. [7M]

    (b) List out the memory hierarchy transformations and explain scalar replacement in case of loop carried dependence spanning single iteration and loop carried dependence spanning multiple iterations with an example? [7M]