

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems.

(c) Write your answers step by step.

Q.No	Question	CO	Marks
Q1	Consider the given below syntax directed translation and execute the arithmetic expression $8 \& 4 @ 7 \& 5 @ 6$ using bottom up and top down parsing. $E \rightarrow E \& T \{ E.value = E.value * T.value \} T \{ E.value = T.value \},$ $T \rightarrow T @ F \{ T.value = T.value - F.value \} F \{ T.value = F.value \},$ $F \rightarrow num \{ F.value = num \}$	5	[3.5 +3.5]
Q2	Consider the code segment: for (i=0; i<n; i++) { for (j=0; j<n; j++) { if (i%3) { x+=3*j + 7*i; y+=(7+3*j); } } } Do the peephole optimization including frequency reduction/loop invariant computation, common sub-expression elimination, strength reduction and dead code elimination. Show your resultant code after every kind of peephole optimization.	6	7
Q3	Consider the arithmetic instruction $-(a+b)*(c-d)+(e+f)$. How many address code instruction is this? Write the corresponding 3-address code of this expression. Make the Quadruples and Triples of this expression and compare in terms of space and time complexity.	6	7
Q4	Consider the following control flow graph. Do the liveness analysis and find out the mutually exclusive live variables in blocks B-2 and B-3:	5	7

	<pre> graph TD B1["B-1: p=q+r+t s=p+q u=s*v"] B2["B-2: v=r+u+t"] B3["B-3: q=s*u*t"] B4["B-4: q=v+r"] B1 --> B2 B1 --> B3 B2 --> B4 B3 --> B4 B4 --> B1 </pre>		
Q5	<p>Refer to the given 3-address code sequence. This code sequence is split into basic blocks by the underlying compiler.</p> <pre> 1001: i = 1 1002: j = 1 1003: t1 = 10*i 1004: t2 = t1+j 1005: t3 = 8*t2 1006: t4 = t3-88 1007: a[t4] = 0.0 1008: j = j+1 1009: if j <= 10 goto 1003 1010: i = i+1 1011: if i <= 10 goto 1002 1012: i = 1 1013: t5 = i-1 1014: t6 = 88*t5 1015: a[t6] = 1.0 1016: i = i+1 1017: if i <= 10 goto 1013 </pre> <p>Show the control flow graph to identify loops. How many numbers of basic building blocks are there and which basic building block is the largest one in terms of number of instructions?</p>	5	7