1. Transactions

A.

(a)

(i)

Assume that the initial balance in two accounts are *a* and *b*, respectively.
(T_1, T_2): A: $a * 0.9$; B: $b + a * 0.1$; $sum = a + b$;
(T_2, T_1): $sum = a + b$; A: $a * 0.9$; B: $b + a * 0.1$;

(ii)

T_1	T_2
$read(A)$	
$temp := A * 0.1$	
$A := A - temp$	
$write(A)$	
	$read(A)$
$read(B)$	
$B := B + temp$	
$write(B)$	
	$read(B)$
	$write(sum)$

Assume that the initial balance in two accounts are a and b respectively
final value: A: $a * 0.9$; B: $b + a * 0.1$; $sum = a + b$;

(iii)

T_1	T_2
$read(A)$	
$temp := A * 0.1$	
$A := A - temp$	
$write(A)$	
	$read(A)$
	$read(B)$
$read(B)$	
$B := B + temp$	
$write(B)$	
	$write(sum)$

Assume that the initial balance in two accounts are a and b respectively
final value: A: $a * 0.9$; B: $b + a * 0.1$; $sum = a * 0.9 + b$;

(b)

(i) One possible schedule:
$r_1(A); w_1(A); r_1(B); r_2(A); w_1(B); r_2(B); w_2(sum);$

(ii) One possible schedule:
$r_1(A); r_2(A); w_1(A); r_1(B); r_2(B); w_1(B); w_2(sum);$

(c)

(i) Yes

(ii) No, $r_2(A); r_2(B); r_1(A); w_1(A); r_1(B); w_1(B); w_2(sum);$

B.

(a) Yes, one example schedule:
$w_2(A); w_1(A); w_1(B); r_2(B); w_2(C); c_2; r_1(C); c_1;$
(b) Yes, one example schedule:
$w_1(A); w_2(A); w_1(B); r_2(B); r_1(C); w_2(C); c_2; c_1;$
(c) no
(d) no
(e) Yes, one example schedule:
$w_1(A); w_2(A); r_2(B); w_2(C); w_1(B); r_1(C); c_2; c_1;$
(f) Yes, one example schedule:
$w_1(A); w_1(B); w_2(A); r_1(C); r_2(B); c_1; w_2(C); c_2;$
(g) Yes, one example schedule:
$w_1(A); w_2(A); r_2(B); w_2(C); w_1(B); c_2; r_1(C); c_1;$
(h) Yes, one example schedule:
$w_1(A); w_2(A); w_1(B); r_1(C); c_1; r_2(B); w_2(C); c_2;$

2. Distributed Query Processing

The sample answers here may NOT be the ones with the lowest data transmission cost.

(a)

(ii)

Site 2:

$Temp1 \leftarrow \prod_{SNO}(VOL)$

Ship $Temp1$ to site 1. Cost = 8 * (20,000*0.4)=64,000 bytes

Site 1:

$Temp2 \leftarrow \prod_{SNO,SNAME,DEP}(STU \bowtie Temp1)$

Ship $Temp2$ to site 2. Cost = (8+30+30) * (20,000*0.4)=544,000 bytes

Site 3:

$Temp3 \leftarrow \prod_{ANO,DEP}(ACT)$

Ship $Temp3$ to site 2. Cost = (6+30) * 1,200=43,200 bytes

Site 2:

$Temp4 \leftarrow \prod_{SNAME,DUTY,ANO}(VOL \bowtie Temp2 \bowtie Temp3)$

Ship $Temp4$ to site 3. Cost = (30+40+6)*6,000=456,000 bytes

Site 3:

$Result \leftarrow \prod_{SNAME,DUTY,ANAME}(ACT \bowtie Temp4)$

Total data transmission cost: 1,107,200 bytes

(b)

(ii)

Site 2:

$Temp1 \leftarrow \prod_{SNO}(VOL)$

Ship $Temp1$ to site 1. Cost = 8 * (20,000*0.4)=64,000 bytes

Site 1:

$Temp2 \leftarrow \prod_{SNO,DEP}(STU \bowtie Temp1)$

Ship $Temp2$ to site 2. Cost = (8+30) * (20,000*0.4)=304,000 bytes

Site 3:

$Temp3 \leftarrow \prod_{ANO,DEP}(ACT)$

Ship $Temp3$ to site 2. Cost = (6+30) * 1,200=43,200 bytes

Site 2:

$Temp4 \leftarrow \prod_{SNO,ANO,DUTY}(VOL \bowtie Temp2 \bowtie Temp3)$

Ship $Temp4$ to site 3. Cost = (8+6+40) * 6,000=324,000 bytes

Site 1:

$Temp5 \leftarrow \prod_{SNO,SNAME}(STU \bowtie Temp1)$

Ship $Temp4$ to site 3. Cost = (8+30) * (20,000*0.4)=304,000 bytes

Site 3:

$Result \leftarrow \prod_{SNAME,DUTY,ANAME}(ACT \bowtie Temp4 \bowtie Temp5)$

Total data transmission cost: 1,039,200 bytes