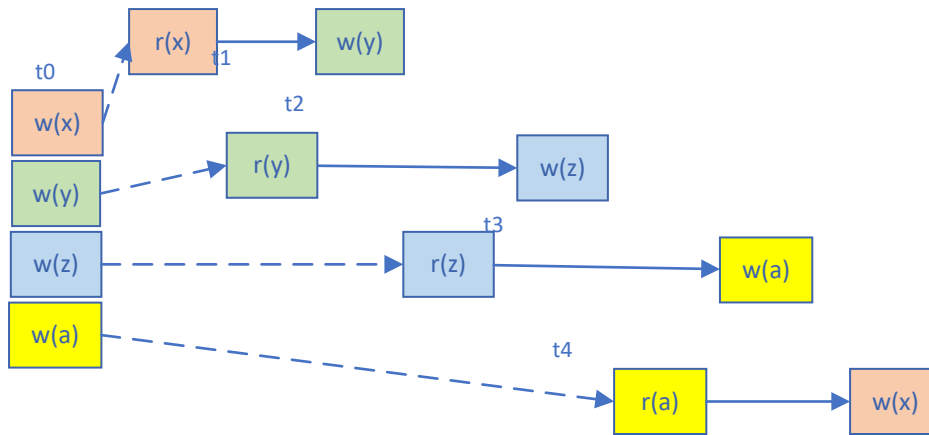


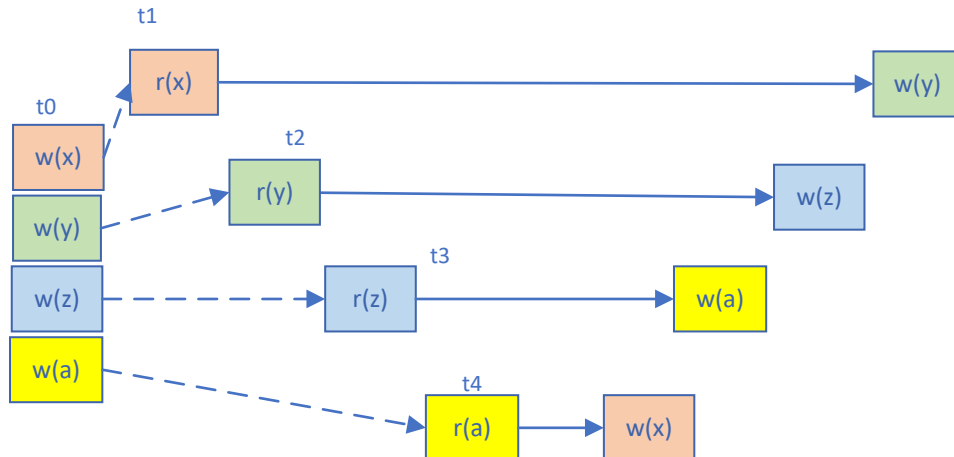
## Write Crown 1 WPが消えていく場合



	C1		C2		C3		C4		C5		C6		C7		C8	
t1	OCC	c	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	Batch	c
t2	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a	OCC	a	Batch	c	OCC	a
t3	OCC	c	OCC	c	Batch	c	OCC	a	OCC	c	Batch	c	OCC	a	OCC	c
t4	OCC	a	Batch	c	OCC	a	OCC	c	OCC	a	Batch	c	Batch	c	Batch	c
	C9		C10		C11		C12		C13		C14		C15		C16	
t1	OCC	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c	Batch	c
t2	Batch	c	OCC	a	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c
t3	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c
t4	OCC	a	OCC	a	OCC	c	Batch	a	Batch	c	Batch	c	OCC	a	Batch	a

t1はBD外

## Write Crown 2 WPが残る場合

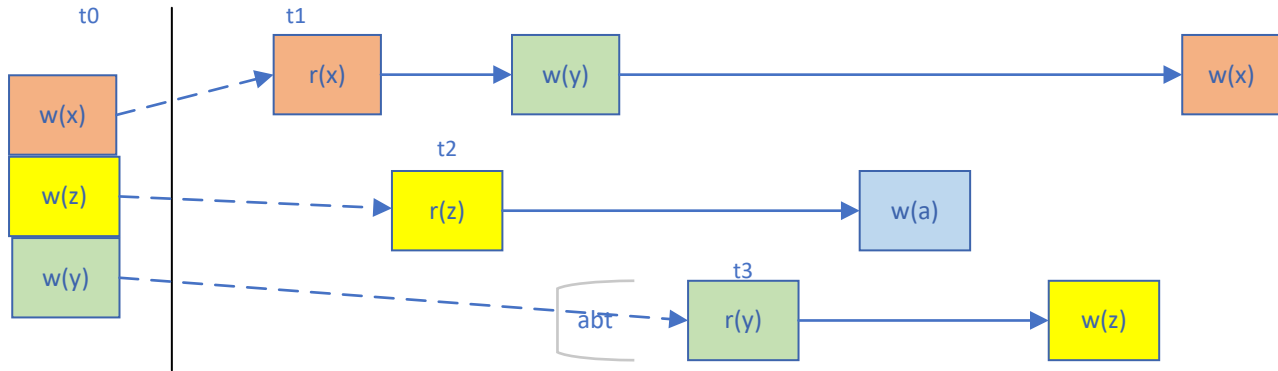


	C1		C2		C3		C4		C5		C6		C7		C8	
t1	OCC	a	OCC	a	OCC	c	OCC	a	Batch	c	OCC	a	OCC	a	Batch	c
t2	OCC	c	OCC	c	OCC	c	Batch	c	OCC	a	OCC	c	Batch	c	OCC	a
t3	OCC	c	OCC	c	Batch	c	OCC	a	OCC	c	Batch	c	OCC	a	OCC	c
t4	OCC	c	Batch	c	OCC	a	OCC	c	OCC	c	Batch	c	Batch	c	Batch	c
	C9		C10		C11		C12		C13		C14		C15		C16	
t1	OCC	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c	Batch	c
t2	Batch	c	OCC	a	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c
t3	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c
t4	OCC	a	OCC	a	OCC	c	Batch	a	Batch	a	Batch	c	OCC	a	Batch	a

t1はBD内

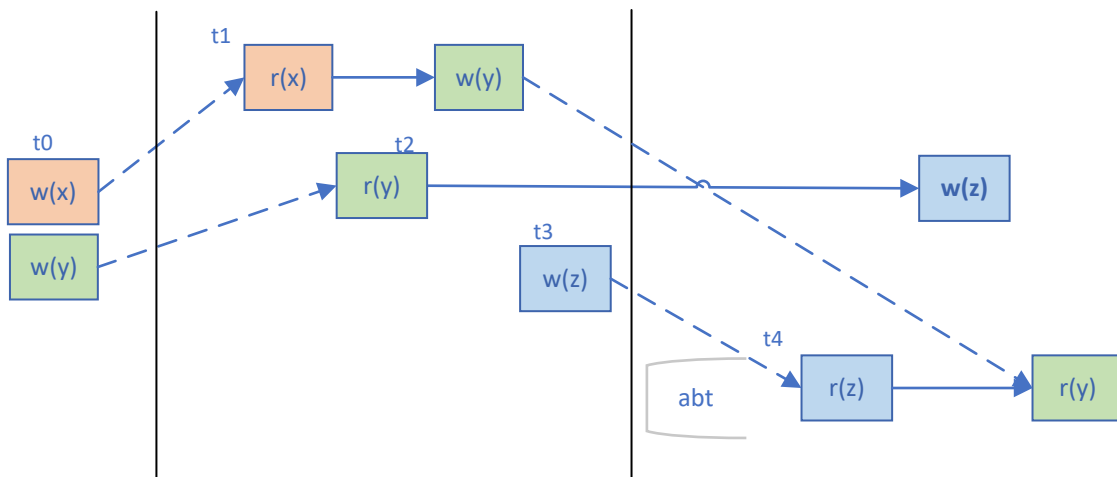
# Sirakami False Positive : serializableではあるが、判定はnot serializableになる

## Write abort



	C1		C2		C3		C4		C5		C6		C7		C8	
t1	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c
t2	OCC	a	OCC	a	Batch	c	OCC	c	Batch	c	OCC	a	Batch	c	Batch	c
t3	OCC	a	Batch	c	OCC	a	OCC	a	Batch	a	Batch	c	OCC	a	Batch	a

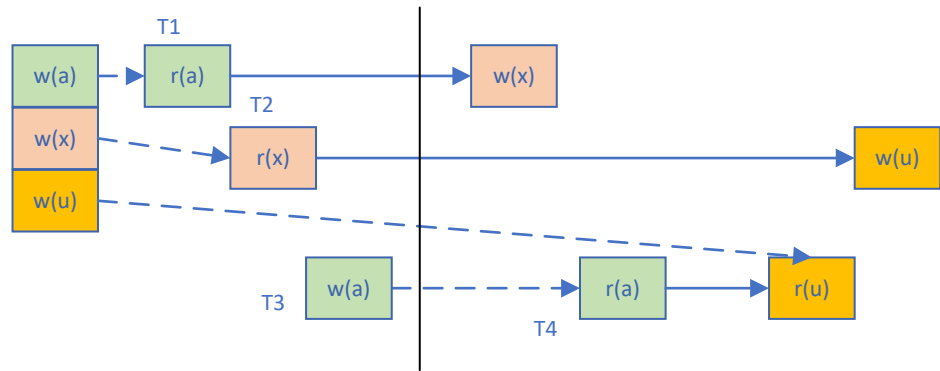
## Read abort



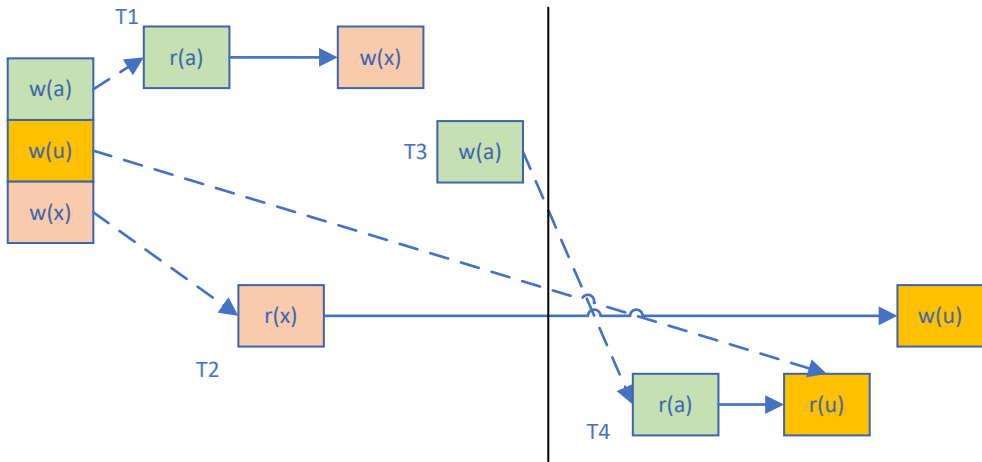
	C1		C2		C3		C4		C5		C6		C7		C8	
t1	OCC	c	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	Batch	c
t2	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a	OCC	a	Batch	c	OCC	a
t3	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c
t4	OCC	a	Batch	c	OCC	c	OCC	a	OCC	c	Batch	c	Batch	a	Batch	c

	C9		C10		C11		C12		C13		C14		C15		C16	
t1	OCC	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c	Batch	c
t2	Batch	c	OCC	a	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c
t3	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c
t4	OCC	a	OCC	a	OCC	a	Batch	a	Batch	c	Batch	a	OCC	a	Batch	a

read onlyがcrownを形成するケース(3項) RoWx2+RO



read onlyがcrownを形成するケース(3項で順序入れ替え)



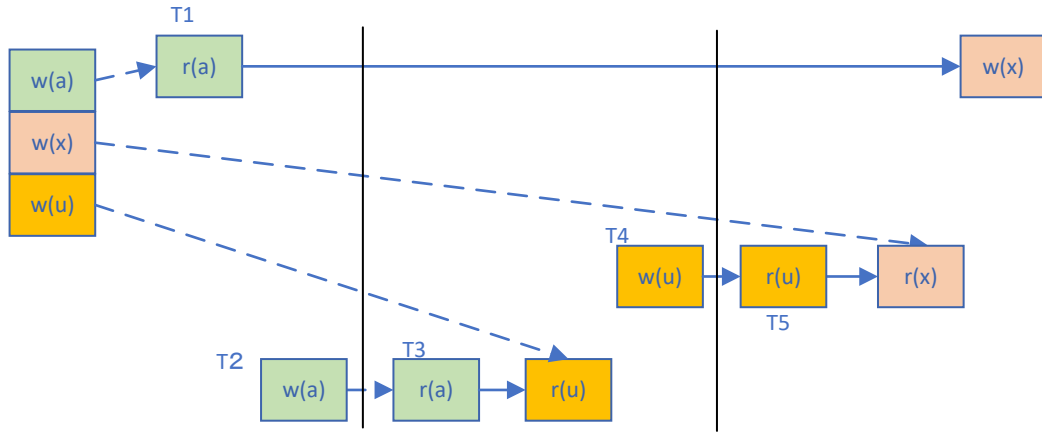
上記の二例ともに同じcommit/abortになる  
読んでいる値も同じになるが、EpochでできるSnapshotが異なる  
異なるSSでも結果が同じであることを確認

	C1		C2		C3		C4		C5		C6		C7		C8	
t1	OCC	c	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	Batch	c
t2	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a	OCC	a	Batch	c	OCC	a
t3	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c
t4	OCC	a	Batch	c	OCC	c	OCC	a	OCC	c	Batch	c	Batch	a	Batch	c

	C9		C10		C11		C12		C13		C14		C15		C16	
t1	OCC	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c	Batch	c
t2	Batch	c	OCC	a	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c
t3	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c
t4	OCC	a	OCC	a	OCC	a	Batch	a	Batch	c	Batch	a	OCC	a	Batch	a

# read onlyがcrownを形成するケース(3項)

ROx2+RoW



	C1		C2		C3		C4		C5		C6		C7		C8	
t1	OCC	a	OCC	a	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a	OCC	a
t2	OCC	c	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	OCC	c
t3	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	OCC	c	Batch	c
t4	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c
t5	OCC	c	Batch	c	OCC	c	OCC	c	OCC	c	OCC	a	Batch	c	Batch	c

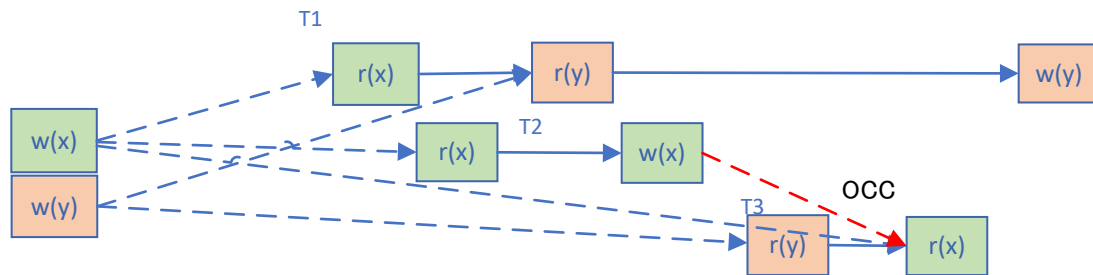
	C9		C10		C11		C12		C13		C14		C15		C16	
t1	OCC	a	Batch	c	OCC	a	OCC	a	Batch	c	OCC	a	Batch	c	Batch	c
t2	Batch	c	OCC	c	OCC	c	Batch	c	OCC	c	Batch	c	OCC	c	Batch	c
t3	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	Batch	c	Batch	c	OCC	c
t4	OCC	c	OCC	c	Batch	c	Batch	c	Batch	c	OCC	c	OCC	c	OCC	c
t5	Batch	c	Batch	a	OCC	c	OCC	c	OCC	a	OCC	c	OCC	a	OCC	a

	C17		C18		C19		C20		C21		C22		C23		C24	
t1	OCC	a	OCC	a	Batch	c	OCC	a	Batch	c	Batch	c	OCC	a	Batch	c
t2	OCC	c	Batch	c	OCC	c	Batch	c	OCC	c	Batch	c	Batch	c	OCC	c
t3	Batch	c	OCC	c	OCC	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c
t4	Batch	c	Batch	c	Batch	c	OCC	c	OCC	c	OCC	c	Batch	c	Batch	c
t5	Batch	c	Batch	c	Batch	a	Batch	c	Batch	a	Batch	a	OCC	c	OCC	a

	C25		C26		C27		C28		C29		C30		C31		C32	
t1	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c	Batch	c	Batch	c
t2	Batch	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c	Batch	c
t3	OCC	c	Batch	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c
t4	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c
t5	OCC	a	OCC	a	Batch	c	Batch	a	Batch	a	Batch	a	OCC	a	Batch	a

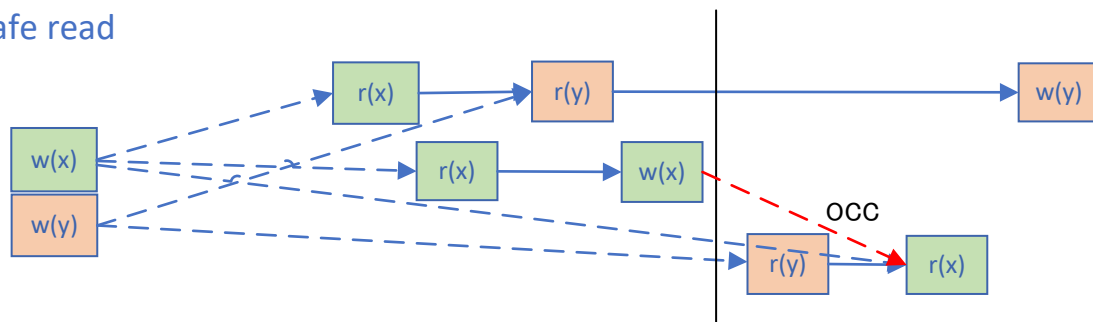
# read onlyがcrownを形成するケース(4項)

## Quasi ROA :False positive Batch readはserializable



	C1		C2		C3		C4		C5		C6		C7		C8	
t1	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c
t2	OCC	c	OCC	c	Batch	c	OCC	c	Batch	c	OCC	c	Batch	c	Batch	c
t3	OCC	c	Batch	c	OCC	c	OCC	a	Batch	c	Batch	c	OCC	a	Batch	c

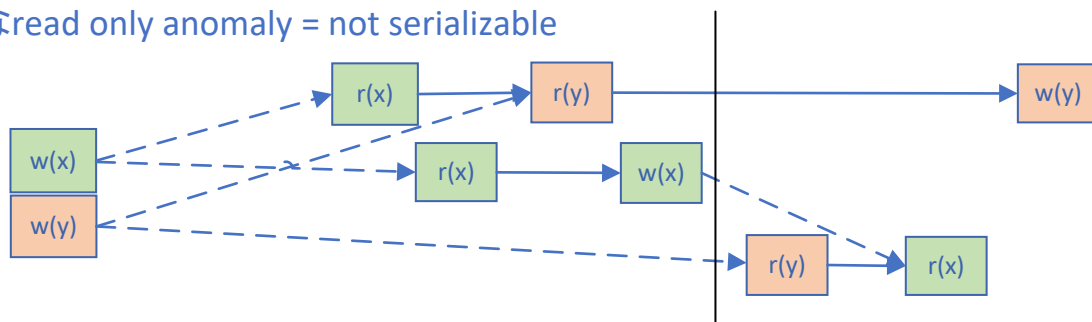
## ROA:Safe read



	C1		C2		C3		C4		C5		C6		C7		C8	
t1	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c
t2	OCC	c	OCC	c	Batch	c	OCC	c	Batch	c	OCC	c	Batch	c	Batch	c
t3	OCC	c	Batch	c	OCC	c	OCC	a	Batch	c	Batch	c	OCC	a	Batch	c

## ROA:UnSafe read

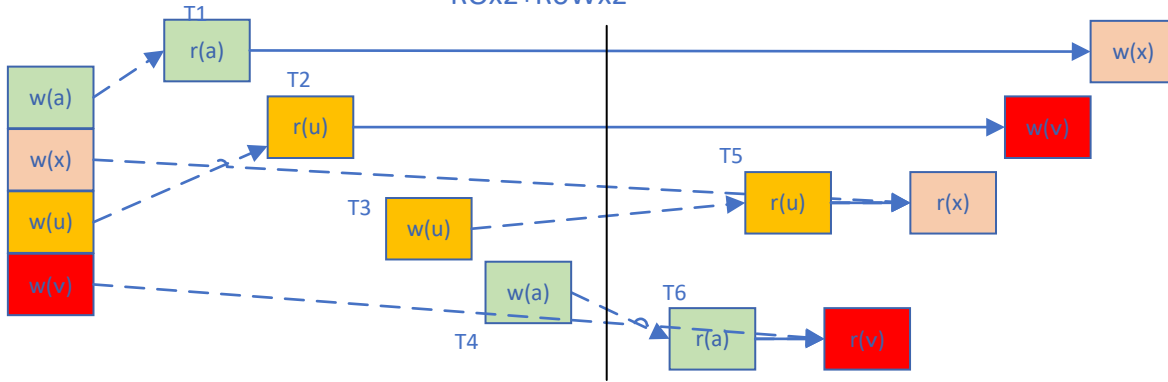
典型的なread only anomaly = not serializable



	C1		C2		C3		C4		C5		C6		C7		C8	
t1	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c
t2	OCC	c	OCC	c	Batch	c	OCC	c	Batch	c	OCC	c	Batch	c	Batch	c
t3	OCC	c	Batch	c	OCC	c	OCC	a	Batch	c	Batch	a	OCC	a	Batch	a

# read onlyがcrownを形成するケース(4項)

ROx2+RoWx2



	C1		C2		C3		C4		C5		C6		C7		C8	
t1	OCC	a	OCC	a	OCC	a	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a
t2	OCC	a	OCC	a	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a	OCC	a
t3	OCC	c	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	OCC	c
t4	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	OCC	c	OCC	c
t5	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	OCC	c	OCC	a	Batch	c
t6	OCC	c	Batch	c	OCC	c	OCC	c	OCC	c	OCC	c	OCC	c	Batch	c

	C9		C10		C11		C12		C13		C14		C15		C16	
t1	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a	OCC	a	OCC	a	Batch	c
t2	OCC	a	OCC	a	Batch	c	OCC	a	OCC	a	OCC	a	Batch	c	OCC	a
t3	OCC	c	Batch	c	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c
t4	Batch	c	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	OCC	c
t5	OCC	c	OCC	c	OCC	c	OCC	a	Batch	c	Batch	c	Batch	c	Batch	a
t6	Batch	c	Batch	a	Batch	a	Batch	c	OCC	c	OCC	c	OCC	a	OCC	c

	C17		C18		C19		C20		C21		C22		C23		C24	
t1	OCC	a	OCC	a	Batch	c	OCC	a	Batch	c	Batch	c	OCC	a	OCC	a
t2	OCC	a	Batch	c	OCC	a	Batch	c	OCC	a	Batch	c	OCC	a	OCC	a
t3	Batch	c	OCC	c	OCC	c	Batch	c	Batch	c	OCC	c	OCC	c	Batch	c
t4	Batch	c	Batch	c	Batch	c	OCC	c	OCC	c	OCC	c	Batch	c	OCC	c
t5	OCC	c	OCC	c	OCC	a	OCC	c	OCC	a	OCC	a	Batch	c	Batch	c
t6	OCC	c	OCC	a	OCC	c	OCC	a	OCC	c	OCC	a	Batch	c	Batch	c

	C25		C26		C27		C28		C29		C30		C31		C32	
t1	OCC	a	Batch	c	OCC	a	OCC	a	Batch	c	OCC	a	Batch	c	Batch	c
t2	Batch	c	OCC	a	OCC	a	Batch	c	OCC	a	Batch	c	OCC	a	Batch	c
t3	OCC	c	OCC	c	Batch	c	OCC	c	OCC	c	Batch	c	Batch	c	OCC	c
t4	OCC	c	OCC	c	Batch	c	Batch	a	Batch	c	OCC	c	OCC	c	OCC	c
t5	Batch	c	Batch	a	OCC	c	OCC	c	OCC	a	OCC	c	OCC	a	OCC	a
t6	Batch	c	Batch	c	Batch	a	Batch	a	Batch	c	Batch	a	Batch	a	Batch	a

	C33		C34		C35		C36		C37		C38		C39		C40	
t1	OCC	a	OCC	a	Batch	c	OCC	a	Batch	c	Batch	c	OCC	a	Batch	c
t2	OCC	a	Batch	c	OCC	a	Batch	c	OCC	a	Batch	c	Batch	c	OCC	a
t3	Batch	c	OCC	c	OCC	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c
t4	Batch	c	Batch	c	Batch	c	OCC	c	OCC	c	OCC	c	Batch	c	Batch	c
t5	Batch	c	Batch	c	Batch	a	Batch	c	Batch	a	Batch	a	OCC	c	OCC	a
t6	OCC	c	OCC	a	OCC	c	OCC	a	OCC	c	OCC	a	OCC	a	OCC	c



	C41		C42		C43		C44		C45		C46		C47		C48	
t1	Batch	c	Batch	c	OCC	a	OCC	a	Batch	c	OCC	a	Batch	c	Batch	c
t2	Batch	c	Batch	c	OCC	a	Batch	c	OCC	a	Batch	c	OCC	a	Batch	c
t3	OCC	c	Batch	c	Batch	c	OCC	c	OCC	c	Batch	c	Batch	c	OCC	c
t4	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c	OCC	c	OCC	c	OCC	c
t5	OCC	a	OCC	a	Batch	c	Batch	c	Batch	a	Batch	c	Batch	a	Batch	a
t6	OCC	a	OCC	a	Batch	c	Batch	a	Batch	c	Batch	a	Batch	c	Batch	a

	C49		C50		C51		C52		C53		C54		C55		C56	
t1	OCC	a	Batch	c	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c
t2	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c
t3	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c	OCC	c	Batch	c
t4	Batch	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c	OCC	c
t5	OCC	c	OCC	a	OCC	a	OCC	a	Batch	c	Batch	a	Batch	a	Batch	a
t6	Batch	a	Batch	c	Batch	a	Batch	a	OCC	a	OCC	c	OCC	a	OCC	a

	C57		C58		C59		C60		C61		C62		C63		C64	
t1	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c	Batch	c	Batch	c	Batch	c
t2	Batch	c	Batch	c	OCC	a	Batch	c	Batch	c	Batch	c	Batch	c	Batch	c
t3	Batch	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c	Batch	c
t4	Batch	c	Batch	c	Batch	c	Batch	c	OCC	c	Batch	c	Batch	c	Batch	c
t5	OCC	a	Batch	c	Batch	a	Batch	a	Batch	a	OCC	a	Batch	a	Batch	a
t6	OCC	a	Batch	a	Batch	c	Batch	a	Batch	a	Batch	a	OCC	a	Batch	a