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Question 1

a. isrc -> mln

isrc -> artist, genre	1. Assumption
isrc, msin -> artist, genre, msin	2. Augmentation of (1)
isrc, msin -> msin	3. Decomposition of (2)
msin -> mln, inst	4. Assumption
msin -> mln	5. Decomposition of (4)
isrc, msin -> mln	6. Transitivity of (3)(5)

The functional dependency is **not** implied by F because there does not exist a valid axiom to reduce equation 6.

b. isrc, rep -> enddate

artist, label -> enddate, rep	1. Assumption
rep -> label	2. Assumption
artist, rep -> artist label	3. Augmentation of (2)
artist, rep -> enddate, rep	4. Transitivity of (1)(3)
isrc -> artist, genre	5. Assumption
isrc -> artist	6. Decomposition of (5)
isrc, rep -> enddate, rep	7. Pseudotransitivity of (6)(4)
isrc, rep -> enddate	8. Reflexivity of (7)

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c. label, msin, artist -> inst, mfn, rep

artist, label -> enddate, rep	1. Assumption
artist, label -> rep	2. Decomposition of (1)
msin -> mln, inst	3. Assumption
artist, label, msin -> msin, enddate, rep	4. Augmentation of (1)
artist, label, msin -> msin	5. Decomposition of (4)
msin -> mln, inst	6. Assumption
msin -> inst	7. Decomposition of (6)
msin, mln -> msin, mfn	8. Assumption
msin, msin -> msin, mfn	9. Pseudotransitivity of (6)(8)
msin -> mfn	10. Reverse augmentation of (9)
artist, label, msin -> rep	11. Decomposition of (4)
artist, label, msin -> mfn	12. Transitivity of (5)(10)
artist, label, msin -> inst	13. Transitivity of (5)(7)
label, msin, artist -> inst, mfn, rep	14. Union of (11)(12)(13)

d. wsin, artist -> genre, royalty

wsin -> wfn, wln	1. Assumption
wsin, artist -> artist, wfn, wln	2. Augmentation of (1)
wsin, artist -> artist	3. Decomposition of (2)
artist -> members, genre	4. Assumption

artist -> genre	5. Decomposition of (4)
wsin, artist -> genre	6. Transitivity of (3)(5)
wsin, artist, royalty -> genre, royalty	7. Augmentation of (6)
wsin, artist -> genre, royalty	8. Reflexivity of (7)

Question 2

a. What is the attribute closure of (msin, wsin)?

(msin, wsin)$^+$ = msin, wsin, mln, inst, mfn, wfn, wln

b. What is the attribute closure of (isrc, label)?

(isrc, label)$^+$ = isrc, label, lcity, lcountry, artist, genre, members, title, album, enddate, rep, syear

c. Identify a minimal superkey for the entire set of attributes, R?

Minimal superkey: isrc, wsin, msin, rep

Question 3

Compute Fc (the canonical cover of F)

Original list of dependencies:

artist -> members, genre

msin -> mln, inst

msin, ~~mln~~ -> msin, mfn {msin}$^+$ includes all the attributes on the left

~~isrc, title, album, artist -> syear~~	$\{isrc\}^+$ includes year; union with other isrc
isrc, ~~artist~~ -> title, album, artist, genre, syear	$\{isrc\}^+$ includes title, album; union added
artist, label -> enddate, rep	
rep -> label	
label -> lcity, lcountry	
isrc, wsin, ~~title~~ -> royalty, title, album	$\{isrc, wsin\}^+$ includes attributes on left
wsin -> wfn, wln	
~~isrc -> artist, genre~~	union with other isrc

Canonical Cover:

Fc = {artist -> members, genre; msin -> mln, inst, mfn; isrc -> syear, artist, title, album, genre; artist, label -> enddate, rep; rep -> label; label -> lcity, lcountry; isrc, wsin -> royalty; wsin -> wfn, wln}

Question 4

a. lossless join decomposition

   Yes

b. dependency preservation

   Yes

c. BCNF

   Yes, because all X's are superkeys for their corresponding relation R.

d. 3NF

   Yes, because it satisfies the conditions for BCNF, therefore will also sastify conditions for 3NF.

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Question 5

a. lossless join decomposition

Yes

b. dependency preservation

Yes

c. BCNF

No, not in BCNF because isrc in isrc -> artist, genre is not a superkey for the song relation.

d. 3NF

No, schema is not in 3NF because artist in artist -> members is not a superkey for the artist relation, nor is (Y – X) contained in a candidate key for the artist relation.

Question 6

a. lossless join decomposition

No, schema is **not** lossless because the musicians' relation does not intersect with any other relation in the schema.

b. dependency preservation

Yes

c. BCNF

Yes, because all X's are superkeys for their corresponding relation R.

d. 3NF

Yes, because it satisfies the conditions for BCNF, therefore will also satisfy conditions for 3NF.