On Exam 2 I had one question (3a) with a relation [A,B,C,D] and a set of applicable functional dependencies: A-->B, B-->C, C-->A

I asked you whether the decomposition of [A,B,C,D] into [B,C] and [A,B,D] was dependency preserving.

It IS dependency preserving, though almost everyone said it was NOT, because the FD C-->A could not be assigned to any table. I expected everyone to so answer, and I gave full credit for that answer (and explanation), but lets understand why the decomposition IS dependency preserving instead, because you may see a like question on the final exam.

A decomposition is dependency preserving iff all FDs in *a* minimal set of applicable FDs is assignable to one or more tables of the decomposition.

But, C-->A is NOT assignable to [B,C] and [A,B,D], so perhaps A-->B, B-->C, C-->A isn't a minimal set, ... but is is? Verify:

A-->B, B-->C, C-->A

- if you do NOT have C-->A, can you determine A from C (from the remaining FDs)? NO
- if you do NOT have A-->B, can you determine B from A (…)? NO
- if you do NOT have B-->C, can you determine C from B (…)? NO

So, A-->B, B-->C, C-->A is a minimal set OF THE SET OF ALL FDs IMPLIED BY IT

- A-->B and B-->C implies A-->C
- B-->C and C-->A implies B-->A
- C-->A and A-->B implies C-->B

. . . and we could keep going, but this is far enough

We have C-->A, A-->C, A-->B, B-->A, B-->C, C-->B

Is there another minimal set of this, besides the one we were originally given?

Yes:

- if you do NOT have C-->A, can you determine A from C (from the remaining FDs)? YES (C-->B, B-->A)
- if you do NOT have A-->C, can you determine C from A (from the remaining FDs)? YES (A-->B, B-->C
- and no others can be eliminated

So an alternate minimal set that is equivalent to the one that the question gave is A-->B, B-->A, B-->C, C-->B

and all four of these can be assigned to a table of [B,C] and [A,B,D]

Essentially, when you say that a decomposition is dependency preserving, you are saying that EACH FD is a minimal set can be enforced by referencing a SINGLE TABLE, and THEREFORE **ALL** FDs that can be inferred from this minimal set are also enforced by referencing single tables (i.e., you don't need to join tables to enforce ALL FDs, both given and inferred). Apropos this, see the "ADDITIONAL DISCUSSION" of question 12 from the Exam 2 key too.