Dear Mr. Meservy,

Your data, while a good start, will not work in a database. I will fix it and make sure that it is up to the standards that it needs to be. To start, we need a primary key to uniquely identify every change made. To do that, I had to break up changes made to the same computer into separate rows and I had to add a primary key to show to make each row unique. You can see this in the image attached below:

| PackID | TagNum | InstallDate | SoftwareCost |
|--------|--------|-------------|--------------|
| AC01 | 32808 | 9/13/1995 | 754.95 |
| DB32 | 32808 | 12/3/1995 | 380 |
| DB32 | 37691 | 6/5/1995 | 380 |
| DB33 | 57772 | 5/27/1995 | 412.77 |
| WP08 | 32808 | 1/12/1996 | 185 |
| WP08 | 37691 | 6/15/1995 | 227.5 |
| WP08 | 57222 | 5/27/1995 | 170.24 |
| WP09 | 59836 | 10/30/1995 | 35 |
| WP09 | 77740 | 5/27/1995 | 35 |

The primary keys are PackID and TagNum. Together, this will insure that you do not install the same software on the same machine.

I also took the liberty to add some important information, the names of the package and the model of computer it's being installed to:

| PackID | TagNum | PackageName | CompModel | InstallDate | SoftwareCost |
|--------|--------|-------------|-----------|-------------|--------------|
| AC01 | 32808 | Google Chrome | Apple | 9/13/1995 | 754.95 |
| DB32 | 32808 | Skype | Apple | 12/3/1995 | 380 |
| DB32 | 37691 | Skype | Dell | 6/5/1995 | 380 |
| DB33 | 57772 | Lotus Notes | HP | 5/27/1995 | 412.77 |
| WP08 | 32808 | Microsoft Office | Apple | 1/12/1996 | 185 |
| WP08 | 37691 | Microsoft Office | Dell | 6/15/1995 | 227.5 |
| WP08 | 57222 | Microsoft Office | Lenovo | 5/27/1995 | 170.24 |
| WP09 | 59836 | SQL Server | ASUS | 10/30/1995 | 35 |
| WP09 | 77740 | SQL Server | Alienware | 5/27/1995 | 35 |

The functional dependencies are:

- PackID → PackageName
- TagNum → CompMode
- PackID, TagNum → InstallDate, SoftwareCost

We need to be able to reach 3$^{rd}$ Normal Form and we are currently not there yet. The PackageName is only dependent on PackID. Likewise, CompModel is only dependent on TagNum. Having SoftwareCost and the InstallDate in the same table makes this not 3NF. In order to make it 3NF, we will have to change the format of the database to multiple tables. Now, it will look like this:

Table: SoftwarePackages
Primary Key: PackID
Dependencies: PackID → PackageName

| PackID | PackageName |
|--------|-------------|
| AC01 | Google Chrome |
| DB32 | Skype |
| DB33 | Lotus Notes |
| WP08 | Microsoft Office |
| WP09 | SQL Server |

Table: ComputersTags
Primary Key: TagNum
Dependencies: TagNum → CompModel

| TagNum | CompModel |
|--------|-----------|
| 32808 | Apple |
| 57772 | HP |
| 37691 | Dell |
| 57222 | Lenovo |
| 59836 | ASUS |
| 77740 | Alienware |

Table: InstalledSoftware
Primary Key: PackID, TagNum
Dependencies: PackID, TagNum → InstallDate, SoftwareCost

| PackID | TagNum | InstallDate | SoftwareCost |
|--------|--------|-------------|--------------|
| AC01 | 32808 | 9/13/1995 | 754.95 |
| DB32 | 32808 | 12/3/1995 | 380 |
| DB32 | 37691 | 6/5/1995 | 380 |
| DB33 | 57772 | 5/27/1995 | 412.77 |
| WP08 | 32808 | 1/12/1996 | 185 |
| WP08 | 37691 | 6/15/1995 | 227.5 |
| WP08 | 57222 | 5/27/1995 | 170.24 |
| WP09 | 59836 | 10/30/1995 | 35 |
| WP09 | 77740 | 5/27/1995 | 35 |

These tables are now in 3<sup>rd</sup> Normal Form because the information in each column is only dependent on its primary key. This will now be fully functional in a database application and we can implement it into software. Here is an ER diagram to show how all of this will be connected:

**SoftwarePackages**

PackID (PK)
PackageName

**InstalledSoftware**

PackID (PK)(FK)
TagNum(PK)(FK)
InstallDate
SoftwareCost

**ComputersTags**

TagNum (PK)
CompModel