PROBLEM SET 3, Phcg 631

1a) How the 2D NMR experiments are generally divided in terms of their pulse sequences?
1b) Explain each of these composing parts of the 2D pulse sequences.
2) What type of structural information 2D COSY NMR spectrum can access on molecules?
3) Explain briefly each composing element of the 2D COSY pulse sequence and name them according to the general scheme of 2D pulse sequences.
4) Explain the differences between diagonal peak and cross-peaks in a COSY experiment in terms of chemical shifts of each dimension.
5) What is an interferogram?
6) What are the downsides of a regular COSY experiments and how we can overcome them?
7) What is the benefit of phase cycling in terms of the 2D NMR coherence transfer pathways?
8) What is the impact of 90^{o} pulses on the 2D NMR coherence transfer?
9) Why the total number of scans should be multiple of the numbers of cycles used in phase cycling?
10) What are the pros and cons of the vector model and product operator formalism to understand the spin evolution during a 2D NMR experiment?
11) How COSY and TOCSY complement each other during spin and structural assignments?
12) What type of structural information 2D TOCSY NMR spectrum can access on molecules?
13) Explain briefly the composing elements of the 2D TOCSY pulse sequence and name them according to the general scheme of 2D pulse sequences.
14) Why setting up the right mixing time in a TOCSY experiment is a crucial step?
15a) Explain briefly the difference of hard and selective pulses in a NMR experiment.
15b) What are the pros and cons of each of these pulses?
16) What is the purpose of gradient pulses in a 2D NMR experiment?
17) Why is the TOCSY spectrum very useful in metabolomic studies?
18) Trace spin connectivities on the COSY spectrum below and make assignments of the horizontal 1D ^{1}H spectrum using the correspondent numbers of the carbon-bound ^{1}Hs on the displayed molecule.