Many (all) the questions have been answered during the Q&A period. Nevertheless, we ask that you provide written answers below so students can come back to read them again. Thanks!

1. (Page 14) Can you please elaborate more on the blind analysis, and is it the only type of analysis?

   Many analyses in the past and some still remain unblinded, i.e. the analyst is able to examine the data in all regions of the analysis, including the signal region (where the signal for a particular process would be expected). This comes with the danger that some choices will be made in a biased way, which is not ideal.

   The blind analysis approach attempts to minimize potential analyzer biases by hiding the data in the signal region. The more sophisticated blind analyses will introduce a hidden shift or something like that in the principal parameter one tries to measure (e.g. shifting the value of the muon g-2 anomalous moment obtained in a fit to the data). At the LHC, one simply does not look at the data in the signal region while designing the analysis. Our Monte Carlo simulation from both the physics and detector response viewpoints is quite good to allow for designing the analysis without looking at the data. However, we will typically look at the data in regions outside the signal region to normalize some main background sources or verify our background estimate.

2. (Page 16) Why do we need 3 generations to explain CP violation?

   CP violation in the SM requires a phase in the CKM quark mixing matrix. With fewer than 3 generations there are not enough degrees of freedom in the matrix to have a phase that cannot be absorbed by a redefinition of the fields.

3. (Page 19) What is a contact interaction? And doesn't all interactions go through a mediator boson?

   Yes, all interactions are mediated by an intermediate particle. A contact interaction appears when one considers effective field theories in which the details of an interaction are not known or not relevant at the energy scale being considered. This idea was fruitfully applied by Fermi in his theory of beta decay in which the nucleons and leptons interact at a point (so called four-fermion point interaction). The details of the weak interaction that we now understand to involve the exchange of a W boson (with mass of 80 GeV) are not relevant when considering neutron beta decay (with a mass of 1 GeV). The d -> u transition with the emission of a W boson can be treated with an effective 4-point interaction. The other way to say this is that at an energy scale of 1 GeV we cannot resolve the details occurring in process involving the exchange of an 80 GeV mediator.

4. (Page 31) What happened in the past and moved the vacuum expectation value of the Higgs field from a zero to a non-zero value?

   Great question to which I wish I knew the answer! Perhaps one of my theory colleagues would like to attempt answering?

5. What would the Lagrangian terms with the vector like fermions look like? Also, what are the projection operators for these and how do they not break the electroweak symmetry?

   There is a detailed paper covering vectorlike quarks at https://arxiv.org/abs/1306.0572. As far as the projection operators for left-handed and right-handed components they would be as usual. The reason they do not break the EW symmetry is provided below in the answer to Q7.

6. (Page 35) By the interaction between composite and elementary what order Will be the operator corresponding to the yukawa coupling?

   A comprehensive discussion about composite Higgs models is provided in https://arxiv.org/abs/1506.01961. The Lagrangian terms for the Yukawa coupling involve dimension 6 operators. You may want to read the discussion of fermion masses via partial compositeness in Section 2.4 ;).

7. (Page 36) Could you explain more about the mass for composite fermions without breaking electroweak symmetry?

   Vectorlike fermions are singlets under SU(2)L, like the right-handed fermions in the Standard Model. This means that the left-handed and right-handed vectorlike fermions are unaffected by transformations belonging to SU(2)L and thus one can write the usual Dirac mass term: m Q-bar Q, as this will remain invariant under SU(2)L. Such a term is not allowed in the Standard Model with chiral fermions as the left-handed and right-handed components transform differently. In the SM, only Yukawa type terms respect the symmetry and eventually provide mass to fermions after electroweak symmetry breaking.

8. How Will be implement the seesaw mechanism for the neutrino in the composite higgs?

   Here also one of my theory colleagues could illuminate this question. But generally, the seesaw mechanism was introduced to explain the lightness of neutrino masses, compared with the other fermions. It is thus a different sort of mechanism to introduce fermion masses in a theory.