Questions to ask

For simple question, we expect students code it themself. We can ask general qusitons like Do you code it by yourself? Possible questions to ask:

Topic 13:

- Q1: Why we need finite volument scheme?
- Q2: From the presentation, both finite element and finite volume mehtod can be formulate in the variational form? What is the main different between them in the variational form in term of trail and test space?
- Q3: For the simplest 1D Poisson eqautions, do you observe any similarity in term of discrete matrix and right hand side?

Topic 3:

- Q1: What is the main difference between Hermite interpolatio and spline interpolation?
- Q2: Why we need spline?
- Q3: In this presenation, you talked about piecewise interpolation? What is the mian advantages do think the piecewise interpolation over the global interpolation?

Topic 15:

- Q1: In general, we could have Dirichlet boundary conditon and Neumann boudnary condition, what is the main difference between them in the physics means?
- Q2: Is the matrix SPD(symmetric, positive definite)?
- Q3: Explain the physical means of your plot?
- Q4: In general, how can we avoid locking?

Topic 16:

- Q1: What is the main difficulty when we add random?
- Q2: Why we need weak order of convergence?
- Q3: What is the main difference between strong and weak convergence?
- Q4: For the stochastic ODE, do we have any constrain on the time step size? For example, do we need similar condition for stability for Euler method?

Topic 9:

- Q1: Why we need iterative method to find eigenvalues?
- Q2: What is the main limitation of Jacobi matrix?
- Q3: Do you compare the Jacobi matrix with power method? Which is more efficient ofr symmetric matrix?

Topic 11:

- Q1: Could you please give an example about stiff problem?
- Q2: Why we need L-stability?
- Q3: What is the main advantange of RKC over other stiff solvers like BDF?

- Q4: Can we apply RKC for general stiff problems?

Topic 14:

- Q1: Why cann't we make use of the low-orde mixed finite elmeent method such as P1-P1? Can you explain in term of matrix property?
- Q2: Why the mixed is called mixed finite element method?
- Q3: How can we impose the constrain p is determined up to a constant when we solve the linear system?

Topic 6:

- Q1: Can we construct an exmaple such that Jacobi method is convergence and Gauss-Seidel method is divergence or Jacobia method is divergent and Gauss-Seidel is convergent?
- Q2: Is Gauss-Seidel alway faster than Jacobi method?
- Q3: For conjuage gradient(CG) method, we know the number of iteration depends on the condition number. For the stationary iterative method, do we have any theorem on it?
- Q4: How can we choose the optimal parameter ω in SOR?

Topic 1:

- Q1: For the shooting method, you choose another initial value for u'(a)? How can guarantee the initial value problem always has a solution?
- Q2: For ODE solver, we have the condition on staibity. How the stabily conditio reflected in the shooting method?
- Q3: For the shooting mehtod for nonlinear problem, we need combine with Newton method. However, for Netwon method, we need the initial guess close enough to the exact soltuion. Do you have any comment on this?

Topic 12:

- Q1: What is the advantage to use orthogonal basis function (or model basis) instead of standard Lagrange basis function?
- Q2: Why we need to consider discontnuous basis function?

Topic 7:

- Q1: What is the main difference between CGNR and CGNE? Do we have similar convergence result as CG for SPD matrix?
- Q2: For CG method, we konw the convergence depends on the distribution of eigenvalue of A? How about CGNR and CGNE?
- Q3: We know GMRES can be apply to general matrices? If you we applied the GMRES to SPD matrix, do we have similar convergence result as CG method?

Topic 4:

- Q1: If x_* is a double root, how about the convergencer rate for newton'e method?
- Q2: Why we do inverse quadratic interpolation instead of quadratic interpolation?

Topic 17:

- Q1: In the graph of speed comparison, why you only test backslash until $N_x = 10^2$. Do you sparse matrix to do it?
- Q2: Why the matrix Q for T and S are the same ?
- Q3: Whether the idea can be extended to 3D case or other type boundary conditions like Neumann boundary conditions?

Topic 5:

- Q1: What the fill-in depends on?
- Q2: Do you compare the time between with ordering and without ordering?

Topic 10:

- Q1: What is the main difference between the adaptive method of line and the standard grid refinement method?
- Q2: In the method line, you would have a grid with very narrow element and very large element? Does this have any impact on the accuracy?
- Q3: Is the monitor function unique? In other words, do you have another choice of monitor function

Topic 8:

- Q1: In the example, you show us the example of multigrid on uniform. Can we apply the multigrid on unstructured meshes?
- Q2: What is the main difference between V\W -cycle with full multigrid?
- Q3: In the smooth step, you mention the Gauss-Seidel? Can we use other iterative methods like CG?

Topic 2:

- Q1: How can we find the quadrature points?
- Q2: Why Gauss quadrature is exact for polynomial of degree 2n-1 and Gauss-Lobatto quadrature is exact for polynomial of degree 2n-3? Can you explicit intuitive the difference?