#	Question	Answer(s)
1	Did we just start the lecture?	Yes there were some technical issues.
2	Can anyone else not hear anything?	live answered
3	would the norm squared of a vector - x vector work or does it have to be x vector - a vector?	Either will work. the sign difference goes away with the norm
4	What are the unknowns?	The unknowns are the 2 values in the x vector (x1 and x2)
5	when will mt2 scores come out?	Should be released later today.
6	why are the quations a1 - b1 and then c1 - a1. There is also a -2 in the top right but anywhere else?	It depends on how we subtract the equations. You can also factor the -2 into (a1-b1).
7	If all the measuremnets are correct, what does least square give?	It should give the correct solution to the system of equations. But this will probably make two equations linearly dependent, so we need to take care when doing the least squares. We will see it later.
8	What does Professor Waller's blue-black diagram mean?	Suppose we are working in R^3. We measured some vector b, but and we want to find the closest vector to that b_hat restricted to the plane col(A).
9	why do we square it?	Its generally nicer to work with norm squared, so we don't have ot deal with square roots.
10	Why do we minimize e?	e is the difference between the real b and our estimation bhat, so we want to minimize it to make our estimation as good as possible.
11	we have two unknown vector here right, x hat and b hat?	Yes, but we know that A*x_hat = b_hat, and A is known. so once we know x_hat, we know b_hat.
12	Why/how does b-hat and b create a right triangle shouldn't they be close to parallel if they need to be similar.	We want them to be similar, but we are stricting b_hat to be in col(A). The best we can do is if the error / difference is perpendicular to b_hat
13	Why do we need a separate variable b hat? Shouldn't we just use b?	b hat is our estimation of the vector b. Remember that b hat can only be in the span of a, but b can be any vector.
14	Is the a vector the A matrix?	Yes in this example the A matrix only has one column, which is the a vector.
15	How do we know what's the a vector?	The a vector is basically given by the problem we want to solve. After we set up the system of equations from our measurements, we will know the a vector.
16	How can we know that the column space is a plane?	This is just part of the example. col(A) is just some general subspace
17	Where did the Cs come from? Why is it c1a1 + c2a2 +… and not just a1+a2+…?	We know that y is in col(A), so it can be written as some linear combination of the a vectors. For linear combination, we need to include those coefficient c1, c2, ... since we don't know what they are
18	why is the inner product of z and the a's equal to 0	That was part of the definitions at the beginning of the problem (it was given to us).
19	Why can't we use Gaussian Elimination to solve for x_hat if we have b_hat?	We don't know either of them at the beginning.
20	how can the vector z be perpendicular to multiple vectors if the vectors arent parallel	In >=3 dimensional space it's possible. A vector perpendicular to a plane is perpendicular to any vectors in that plane. Vectors in a plane can be either parallel or not.
21	should the x in Ax have a hat on top	In this case no. We're using the identity Ax = b + e -> e = Ax - b
22	isnt it x hat????	On the right side, yes we should have b = A*x_hat
23	Why are they(A and b-Ax) perpendicular?	b-Ax = e, the error vector. We want the best estimate for x_hat, so we want to minimize the norm of the error vector. That occurs when the error vector is perpendicular to col(A)
24	Why is bhat Axhat	bhat is defined by Axhat. bhat is our estimation of the vector b from xhat, which is our estimation of the vector x.
25	Why isn't A_T*A the identity matrix	A_T, the transpose, is not guaranteed to be the inverse of A. In general, it is not.
26	i thought we started by getting b hat	Conceptually, we start with A and b, which are like the masks and measurements from imaging. We want to find x_hat and b_hat that gives us a best estimate.
27	why would we need to find b_hat	sometimes we want to check our estimation error, i.e. the difference between b and bhat
28	will we be given a problem where we need to solve for the x vector even though the columns of A are linearly dependent?	such a problem is in scope
29	How many dimensions will we me asked to solve on the exam	we won't make the matrices unreasonably big for the time given
30	I thought x was supposed to be a vector? what does x being a scalar tell us?	In that example x is a scalar, or a 1x1 vector.
31	how did you get the b hat equation on the left side?	b_hat = A * x_hat. So once we have x_hat, its just A * x_hat
32	If we use Gaussian Elimination first on a system then use the least square algorithm, will that change the result?	Yes that can change the result since Gaussian elimination will change the column space of the matrix A.
33	do we always multiply matrices from right to left?	We typically multiply from left to right, but we can also use the property ABC = A(BC)
34	When will we get our midterm 2 grades?	should be releasing later today
35	how did we know to do ATb to multiply to ATA-1 instead of ATA-1 multiplied to AT then b?	You can do either. They yield the same result
36	Why is A not invertible?	In these problems, A is generally not square. So it's not invertible
37	If there is no noise will leadt square give us the same solution as GE and that is why we should always do least square?	Yes. The idea is the GE works when we have an exact solution. So when an exact solution exists, the "best estimate" will be the exact solution
38	do we need the system to be overdetermined for least squares to wrok?	yes. underdetermined systems require different algorithms
39	What happens if col of A are Lin dependent ?	Then we won't be able to execute least squares. We have to manipulate our A matrix so we can get a LI matrix
40	what would it mean if b_hat was exactly a, like the projection of b onto a was a, i.e alpha = 1	This has no special meaning. It means the estimation xhat =1.
41	Kinda random, but how are orbital trajectories of planets determined now? (not by least squares right?)	The fundamentals are the same. Measure the positions, fit to a model with least squares.