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OfficeHours_IS4_20160428_Seg01.pdf

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**Setting: quiet classroom. Reference a lot to a binder in front of S1.
Participants: S1 (male, black and white check scarf), IS4 (male,
maroon sweater, glasses)**

0:00

XXX IS4: do you have the textbook?
XXX S1: I do not
XXX um:
XXX but the question is five point one and-
XXX IS4: I- I- I- I- didn't-
XXX I didn't have a (.) textbook
XXX you don't have a text book.
XXX alright (.) um:
XXX well then I have a very specific question that should be
XXX fine anyway
XXX IS4: ok° ((slight nod))
XXX S1: so f- u:m
XXX what I wanted you to do
XXX ((starts writing on paper))
XXX uh I have-
XXX it was the same problem you were just working on
XXX IS4: ((nods))
XXX S1: uh: it was part b though (.1)
XXX and
XXX yea
XXX so what they do is we have (.1) this matrix (.1)
XXX uh:
XXX and vector of (.) unknown,
XXX except now they give you (.1)
XXX x one is five
XXX IS4: x one is five°
XXX S1: so
XXX doesn't this create[↑] an: overdetermined system?
XXX in this case?
XXX because (.3) you have-
XXX IS4: is this b is still a vector?°
XXX S1: yea
XXX isn't that an overdetermined system though?
XXX because you have (.1) two unknowns[↑] and three equations now?
XXX IS4: two un,- uh it
XXX S1: can this be=
XXX IS4: =three unknowns right,
XXX S1: oh sorry there are- three three unknowns

XXX and- and
XXX yea
XXX three unknowns and-
XXX so you have a more than:
XXX IS4: three unknowns and three equations I think (.)
XXX that's exactly (.) enough°
XXX S1: oh [((incomprehensible))
XXX IS4: [((incomprehensible))
XXX and
XXX because
XXX you know
XXX this three equations↑ and three: p- [unknowns
XXX S1: [right
XXX right so wait this is three by four,
XXX this is a (.) four by (.)
XXX ((incomprehensible, counting))
XXX four by one,
XXX that would give you [(.) three by one
XXX IS4: [m
XXX S1: ah
XXX IS4: yea
XXX so (.) I thin-
XXX this (fine) is just to make- to make this (.) exact
XXX sufficient° because
XXX i- if- if this five↑ is unknown it will be° (.)
XXX over too much°
XXX S1: so then what I would do is I would just (.)
XXX solve the system?
XXX IS4: yea=
XXX S1: =so add as (.) as I normally would,
XXX IS4: yea yea
XXX S1: (and that would be)
XXX (and this is zero°)
XXX this is::
XXX IS4: uh::=
XXX S1: =x four is-
XXX [oh wait
XXX IS4: [no yo- (.1) you should- you should use this five
XXX like two times five, (.1)
XXX two times five plus like=
XXX S1: =oh alright
XXX two times five
XXX IS4: two times five ((affirming))
XXX and plus (.)
XXX one times (.) vecto:ral↑ five times (.1) that three

XXX and zero times that four=
XXX S1: =ah:
XXX ok=
XXX IS4: =so this will give you a system°
XXX S1: ((nods))
XXX IS4: uh: ((incomprehensible))=
XXX S1: =so this will just make it easier to solve,
XXX and then I'll get [a more specific solution
XXX IS4: [yea
XXX yea yea=
XXX S1: =four x two x three and x four [((incomprehensible))
XXX IS4: [yea
XXX n- (.) th- th- this five will cancel out.°
XXX S1: oh lose the five.
XXX IS4: yea
XXX and (.) and you will get- get a system like (.)
XXX uh let- let me show you ((writes with pen))
XXX uh: so
XXX **the first row↓ will become two times-**
XXX c- can I- can I write on this?°
XXX ((asking if he can write on paper))
XXX S1: yea sure go ahead
XXX IS4: so it becomes like two times° (.2)
XXX plus (.) one times six two°
XXX and six two (.) times (.) five times (.3) and:°
XXX ((speaking while writing))
XXX plus zero times (.) it will be zero°
XXX S1: mhm
XXX IS4: and it will (.)
XXX so the first row will become this
XXX ((underlines something))
XXX and
XXX this two times five you can (.1)
XXX you can (.) move it to the right side.
3:00
XXX S1: [ok
XXX IS4: [it will become (.) minus ten
XXX ((looks at S1))
XXX S1: right
XXX ((IS4 starts writing on paper again))
XXX IS4: you will get a (.) like
XXX x two (.) plus five times
XXX x (.) three: ,
XXX plus zero times x (.) four°
XXX ((pauses are due to writing and speaking @ once))

XXX zero times x four (.)
XXX ((quiter)) zero times x four°
XXX so (.) you-
XXX i- in this- in this way you will↓
XXX convert this into a (.1)
XXX into another system like a x equals b
XXX this b will have (.2) will be not↑ (.)
XXX zero zero zero
XXX it will be like (.) minus ten
XXX minus ten: is ((incomprehensible))
XXX S1: [ok
XXX IS4: [so you will convert this one into another system
XXX S1: ((nods))
XXX ok
XXX IS4: is it clear?
XXX S1: I think so yea that makes sense
XXX so I'm gonna have (.2)
XXX three equations (.)
XXX [three unknowns
XXX IS4: [yea three equations three unknowns=
XXX S1: =and I'll be able to just systematically solve them=
XXX IS4: =yea
XXX yea yea
XXX S1: ok
XXX and I could probably do what,
XXX I could probably do elimination method↑ to solve that?
XXX [it should work?
XXX IS4: [yea elimination
XXX ((both mumbling at the same time))
XXX S1: ((jogging notes down))
XXX ((incomprehensible)) do that
XXX and then (.) for the part before it,
XXX I (.) don't remember the exact question in the text book
XXX but u:m
XXX ((pause))
XXX ((looking at notes))
XXX I believe this is ((to himself))
XXX yea yes
XXX so you've given this vector,
XXX you have to find the [(known)
XXX IS4: [yea
XXX yea:=
XXX S1: =that's all I do right,
XXX I'm just solving this system?
XXX [u:m

XXX IS4: [so the
XXX y- yea
XXX you- you find-
XXX you will find this system will help°
XXX will have solutions°
XXX S1: right
XXX IS4: right,°
XXX so: (.)
XXX what is the problem to this one?
XXX y- you need to find the (known space)
XXX or something like that°
XXX S1: uh:
XXX y- oh oh oh
XXX it's- it's this one.
XXX it's this one ((points on paper))
XXX this is a three by three.
XXX IS4: oh oh
XXX this one
XXX S1: (find the space between the three by three)
XXX it's gonna to be the same thing
XXX I have to reduce this
XXX IS4: reduce yea:
XXX S1: in order to solve the system,
XXX IS4: yea
XXX S1: and that gives me (.1)
XXX is that (.) is that a solution?
XXX I mean it's a solution right,
XXX but it's a family of solutions.
XXX IS4: yea a family of solutions.°
XXX S1: so I was told by one of the u:m
XXX when we had uh: (Kauffman)↑ sub in,
XXX he told us that (.)
XXX we're given the solution
XXX by the problem
XXX ((IS4 nods))
XXX and then plus (.) s-
XXX the multiple of another solution [as a family solution
XXX IS4: [yea yea
XXX S1: does this solution come from (.1)
XXX the null space?
TTF IS4: yea
TTF in fact (.)
TTF this one is (the duct level)
TTF the n- the the:
TTF the null space°

XXX S1: the solution's a null space ((nods))
XXX goes here. ((points at paper))
XXX IS4: yea=
XXX S1: =and that would be the final answer then,°
XXX IS4: yea
XXX this specific solution
XXX [but
XXX S1: [for this specific solution plus-
XXX IS4: plus uh-
XXX S1: some multiple of another solution.
XXX IS4: yea
XXX plus the: family of (quality) (.) of null space°
XXX S1: ok so this part is the family then.°
XXX IS4: yea
XXX S1: [oh ok
XXX [this part is family
XXX and this one is the: (((incomprehensible))
XXX S1: [the ((incomprehensible))
XXX ((both said the same thing though))
XXX oh ok
XXX that makes sense.
XXX thank you
XXX u:m
XXX I'm trying to see if I have another question here, (.3)
XXX ((points @ paper, writes))
XXX oh (.1)
XXX there was a problem in the book (.3)
XXX I don't know how to do this
XXX I- I might not be able to ask you this
XXX because I don't have the book on me and I don't remember-
XXX I wasn't expecting to (.) be done so quickly°
XXX ((incomprehensible))
XXX u:m
TTF IS4: the: the (.) th- it sh- sh-° (.1)
6:00
TTF that shoul-°
XXX that should be three=
XXX S1: =a third
XXX right?
XXX IS4: that?
XXX S1: yea
XXX that's what I thought
XXX um: (.)
XXX there should be
XXX IS4: ah ((nods))

XXX S1: but there's only: (.) two solutions that they give you
XXX IS4: two uh
XXX S1: maybe I read the problem wrong↑ but it looked like they only
XXX gave me two solutions for two by three
TTF IS4: no n- I- I think it's right
TTF it- uh: if-
TTF if you write it in this form it is right
TTF [so if
XXX S1: [oh:: I see
XXX I see
XXX right=
XXX IS4: =you know there are two rows that means (.)
XXX S1: right=
XXX IS4: =the rest a- should have two: (.) (two dials)
XXX S1: oh:
XXX ok
XXX it should be-
XXX ok it should be two by one
XXX IS4: ((nods))
XXX S1: [((incomprehensible))
XXX IS4: [so two by three:
XXX three by one:
XXX and you'll get a two by one.
XXX S1: ok
XXX u:m
XXX alright
XXX I guess uh:
XXX I guess that's it honestly
XXX ((IS4 nods))
XXX thank you very much
INT IS4: ok
INT ((S1 organizing papers))
INT so do (.1)
INT do you need-
INT n- do you need-
INT ((incomprehensible))
XXX S1: what do you mean?
XXX IS4: you: ask me before:↑ there? ((points off camera))
XXX S1: oh yea yea wait
XXX [whatever you guys did
XXX IS4: [yea ((incomprehensible))
XXX S1: u:m
XXX with-
XXX wh- what were you explaining to him about the u:m
XXX IS4: the-

XXX how do I explain null space?
XXX S1: yea yea
XXX IS4: yea the null space is uh:
XXX null space (.)
XXX oh
XXX just take this, ((points at notes))
XXX ((S1 nods))
XXX S1: mhm
XXX IS4: take this as a- as an example°
XXX so (.) m:
XXX generally speaking. (.2)
XXX there are (.) two equations,
XXX and two unknowns,
XXX ((S1 nods))
XXX you should get a-
XXX you should get (.1)
XXX you should get a exact solution
XXX S1: right
XXX IS4: it's one equals (.1) something,
XXX and it's two equals something°
XXX but in th-
XXX in this example
XXX this (f one) too will have many (.1)
XXX many (.) solutions (.)
XXX S1: [right
XXX IS4: [which
XXX because (.)
XXX because
XXX ((pause))
XXX uh
XXX in fact this is overdetermined system
XXX be- because they are:
XXX **can I:↑ write on this?**
XXX S1: alright- that could- ((gestures to another sheet))
XXX IS4: ok
XXX S1: I'll rip it out
XXX ((rips out sheet and hands it to IS4))
XXX IS4: so- ((writes on paper))
XXX one minus two and uh°
XXX ((pause))
XXX vectoral x two° (.1)
XXX zero zero
XXX u:m (.3)
XXX if you: (.2)
XXX if you want-

XXX if you write- write this to
XXX in the equation for
XXX x one minus two:,
XXX x two zero (.1)
XXX minus two x one
XXX plus four x two
XXX equals zero.
XXX ((looks up at S1))
XXX ((S1 nods))
XXX S1: mhm
XXX IS4: right,
XXX S1: right
XXX IS4: and (.1) you: divide this (.) by (.)
XXX minus two
XXX S1: mhm
XXX IS4: on both sides
XXX S1: yea
XXX IS4: you will get ((writing))
XXX (.2) you will get (much)
XXX it will become (.1)
XXX x one[↑] minus x two
XXX equals zero
XXX S1: right
XXX IS4: so this one is exactly the same as this one[°]
XXX S1: oh: (.)
XXX yea
XXX [yea
XXX IS4: [yea
XXX so that means
XXX these system is overdetermined
XXX i- it have redundant (.) information.
XXX S1: oh:
XXX so it's the same equation twice
XXX IS4: yea so
XXX thi- this will cause you to get (.)
XXX a family of solutions.[°] (.1)
XXX because it- it- it doesn't provide enough s-
XXX information
XXX S1: right
XXX IS4: and (.) in this (.) so
XXX in fact this system is only (.)
XXX one equation li- like this one.
XXX S1: mhm=
XXX IS4: =and (.) you can sa-
XXX if you said this is true to be one,

XXX (.1) you will get two x one to be: two
 XXX right,
 XXX S1: yea
 XXX IS4: if you said this to be: two (.1)
 XXX you will get x one to be: four
 XXX S1: oh: ok that-
 XXX oh [so it's like finding ((incomprehensible))
 XXX IS4: [((incomprehensible))
 XXX S1: there's multiple ((incomprehensible)) vectors.
 XXX right,=
 XXX IS4: =yea yea
 XXX so
 XXX S1: ok
 XXX IS4: and (.) i- i- i- if you set this x (.) two to be
 XXX three you will get this to be (.) six
 XXX right,
 XXX S1: yea
 XXX IS4: y- y- y- you will find that (.1)
 XXX any
 XXX any solutions like (.) x one
 XXX and (.2) oh (.) two x two°
 XXX x two° (.)
 XXX will satisfy this equation°
 XXX [right,
 XXX S1: [mhm
 XXX IS4: and if you-
 XXX if you let this x two out (.)
 XXX take this out you will get x two minus° (.1)
 XXX times two: one
 XXX ((S1 nods))
 XXX S1: right°
 XXX IS4: all this y-
 XXX all the vectors in this form is the solution
 XXX to this one right,°
 XXX ((S1 slightly nods))
 XXX (that- that's the family of the null space°)
 XXX S1: o:k
 XXX IS4: that's why we call it
 XXX we call it (.)a family (or)° (.1)
 XXX because an- and this two one is the-
 XXX is the basics
 XXX S1: right
 XXX so this is any- any multiple of- of the solution
 XXX IS4: yea
 XXX any- any multiple of the solution=

XXX S1: =so that's why there's an infinite number of solutions=
XXX IS4: =yes
XXX S1: ok
XXX IS4: and (.) th- this is the basics (.)
XXX [too right,°
XXX S1: [mhm
XXX IS4: and (.1)
XXX for example if-
XXX m but if you (.2)
XXX add two: time
XXX the multiple of two:
XXX you can also- it produce in this way
XXX like
XXX x three time- times two, (.2)
XXX they're equivalent
XXX ok,
XXX S1: mhm
XXX IS4: is that clear?
XXX S1: yea=
XXX IS4: =so
XXX this four two is (.) is not (.)
XXX it's can be also called the basis
XXX S1: right
XXX IS4: yea
XXX so that (.) that's-
XXX that's how to (come through)
XXX S1: o:[k
XXX IS4: [((incomprehensible)) the (.)
XXX the ba- the family of (.1)
XXX the family of solutions (in the null space)°
XXX S1: right
XXX so
XXX if they ask for null space
XXX I can give any one of these and it'd be correct?
XXX IS4: uh:
XXX if- if it gives you
XXX yea
XXX you can: y- you can wri- wri- write the:↓
XXX you can write the:↓ null space like (.) [this one
XXX S1: [like that
XXX IS4: yea [and
XXX S1: [so I can show that (.)
XXX it's a multiple of that
XXX IS4: yea any multiple of-°
XXX any multiple of the basis=

XXX S1: =right
XXX and if they give you a specific solution
XXX the answer is just (.)
XXX the specific solution that they give you (.)
XXX so=
XXX IS4: =the [specific°
XXX S1: [the solution plus some multiple of (.)
XXX another solution?
XXX is that just like a general thing?
XXX cus that's what they did for the other problem=
XXX IS4: =yea
XXX so (.) the: if you-
XXX i- i- if you: talk about the specific solution usually (.)
XXX the w- the right side is not there
XXX ((S1 nods))
XXX S1: right
XXX IS4: so if- if- if the right side is not $x \uparrow$ equals b
XXX so (.2)
XXX the specific solution (.)
XXX is a solution
XXX to this- to this b is not- ((pointing at paper))
XXX is not there
XXX S1: [mhm
XXX IS4: [and (.2)
12:00
XXX the solution to- to (.) the: for-
XXX the family of the solution to this one is
XXX this specific x plus (.1)
XXX plus (.) the (.1)
XXX the null space of
XXX of b
XXX that means
XXX the solution to x equals zero
XXX S1: o:[k
XXX IS4: [all the solutions to this one
XXX plus the specific solution to this one
XXX S1: ok ((nods))
XXX alright
XXX IS4: that's the ((incomprehensible)) from the (.) text book
XXX S1: alright now I get it
XXX ok
XXX alright thank you very much (.2)
XXX ((nods)) that's it
XXX thanks

