

KEEP ON CODING

A stage musical by Eric M Love

MCMXCIX

Acknowledgements

This opus may never have been, if not for these: Arthur Sullivan & W.S.Gilbert, whose excellent comic operas inspired me to write something of the same genre; Brett Czeckowski, my piano teacher (93-94) and Nikki Kotrotsos, my drama teacher (93-96); God, who invented music; Karly Winkler, who in April 98 literally dreamed up the idea of singing in the Kerr Grant lecture theatre; Joseph Kuehn, who got me excited about SEP and on Sat 14 Nov 98 showed me the SEP exam paper with a question about CoCoMo (oh, for a calculator!), immediately bringing to mind the possibility of writing a song about it; the student who brought a tape recorder into a Maths Applications lecture in August 1997 and played "Tea for Two"; and those who wrote songs which made it into here, however distorted.

The story behind the musical:

(This story starts in several places with little relevance to each other, but it all heads in the same direction).

One of my ambitions when I came to university in 1997 was to spend an unhealthy amount of time in the theatre. This didn't happen for plenty of reasons - I hadn't much spare time, the uni theatre groups took people with significantly more experience and talent than I (or so I thought) and the shows they performed were not always to my taste.

The Kerr Grant Lecture Theatre in the Physics building was named after the entertaining Professor Kerr Grant, whose physics lectures in the 40s are still remembered today, more than any other lecturer at the university. Both I and another student had dreams which included people standing on the long desk at the front singing.

At the uni Evangelical Union mid-year conference in 1999, our theme song was "The Best Book to Read", an old Sunday school song, and we were invited to arrange entertaining versions of it during the week. I wrote an arrangement for barbershop quartet and was surprised that I could write music which sounded good. I expected to do similar arrangements thereafter.

Two of my three subjects in Semester 2 of 1999 were of particular interest: Coding & Cryptology and Software Engineering & Project. On these two a musical was written.

Coding & Cryptology, a third year pure mathematics subject taught by Bob Clarke and Catherine Quinn, was by far the most popular of all the maths subjects in third year. The way cryptology was introduced with the characters Alice, Bob and Oscar (see the cast on the next page) made it childish fun and lent itself to drawing cartoon strips of the characters during lectures.

Software Engineering & Project is the hardest of the third year computer science subjects. In 1999 it was taught by the enigmatic and most unpopular Fred Brown and the less unpopular Michael Oudshoorn. In what is some students' only taste of group project work, groups developed a program to run a train set based on the Belair train line. Students work long hours to the detriment of their other subjects, especially in the week before the initial demonstration (some students work over 60 hours in that week). To allow students to concentrate more on the legendary project in Term 4, the lectures were two hours long for the first five weeks and none thereafter.

Knowing that double length lectures would include an intermission and remembering someone playing some music in an intermission two years before, I wrote Assignment Three and hoped to sing it in the middle of an SEP lecture, but I could not pull enough people together for a quartet. Eventually I went looking for music students. When I found some willing and able singers the SEP lectures had finished, but

we sang Assignment Three at the beginning of a C&C lecture (in the Kerr Grant) to great applause. (As a result of this, Trevor Tao and I became partners in mischief and together we made a computer game in 2000). Buoyed by this success, I wrote The Train Don't Stop, which we sang at the beginning of another C&C lecture. Not having practised very much, we sounded poor that time but thereafter the class was always expecting another performance.

Between Terms 3 & 4 (as well as working on the Project) I wrote more songs and a script to hang them on. In Term 4 I advertised an upcoming production of Keep on Coding as one for people who had wanted to perform in such a show but didn't think they were good enough. I made arrangements for performing in the Kerr Grant at lunchtimes at the end of the term. Unfortunately, everyone was too busy with their studies and while many applauded the idea, only a few people were interested in performing instead of the fourteen singers required. Not all of the music was written before it was apparent that a 1999 production wouldn't happen.

Over the years since 1999 I filled in all the gaps, rewrote some of the songs and embellished the script. I used Cakewalk Home Studio to put all the music together. Before 2000 I had not seen a musical score (besides the one I wrote in 1993-94!), so my style was fairly basic so material written later was much improved. I'd always been a fan of Gilbert & Sullivan (no.8 is very G&S), but it wasn't until 2000-01 that I got more familiar with their style, and tried to emulate some of it, particularly the high rhyming rate. I also wrote the finale nice and long.

Although most of KoC was written by 2004, it wasn't until Dec 07 that I had the full score together. So it's now complete, although in the tradition of free software I may make alterations and upload a new copy.

The Cast:

When Dr Clarke taught cryptology, the person sending the messages was always described as Alice, the one receiving them as Bob and any opponent who would intercept messages and attempt to decrypt them was known as Oscar, thus the three main characters.

Alice (alto) - Wears a shirt or hat with an A. Sings one song herself, and has plenty of singing in the other numbers.

Bob (bass) - Wears a shirt or hat with a B. He sings one song himself, and sings a lot in the same numbers as Alice.

Oscar - The melodramatic villain, opponent of Alice and Bob.

A Courier, wearing a C if possible.

Two thugs, friends of Oscar.

A typical group of students doing the Software Engineering Project. They usually sing in quartet, and have a few different costumes. Their names aren't used.

Pete (baritone)

Rod (baritone) - He always wears a US railway conductor's hat, and has a song to himself.

Alex (tenor) - Always enters and exits first, followed by the others.

Nick (bass) - Always enters or exits last, sometimes entering just in time to start singing.

Greg (guitarist) - Doesn't sing with the others, but sometimes carries his guitar on and plays along.

There is a chorus of eight (the ideal number for standing on the desk in the Kerr Grant): two sopranos, two mezzos, two altos and two baritones. They are not characters, but simply hang around to sing a lot of the songs, usually in four parts. The alto part is quite low, so the music often looks like the standard SATB. One of the altos sings "Ben's song", but the rest have no solos except for two in the finale. They could spend some of the time sitting in the audience.

One person, described in the script by MC, is there as something of a narrator - to get the characters to explain what is going on. The other person who would appear would be someone operating a computer which both plays the backing music (with varying volume levels, use of the volume dial is in order) and displays words (and other information) on a large screen. (The PowerPoint show is about the only thing

missing now). As you can see, I like to remove boundaries between cast, crew, audience and orchestra. Either of these or the courier could also be in the chorus.

Songs:

In the case of five of the songs, someone else's song was taken and the words were changed, still leaving a hint of the ones which were there to start with, to be sung to the original tune. All five were originally written in the computer room one day while I was waiting for one of my Project group to arrive, although they have been heavily revised since. In no.10, since the music is the same as the original, I decided a karaoke track derived from the recording of the original song would make the accompaniment rather than a MIDI arrangement. Many CD recordings have the main vocal part in both left and right channels with exactly the same strength while most of the instruments are mostly (or all) on one side or the other. Thus by making a mono track which is the mathematical difference of the two original tracks (I wrote a program to do this) you can have the accompaniment (albeit with the instruments out of balance) to which you can sing along. I hoped to do this with no.2, but the backing vocals weren't centred.

Before the semester started there were a number of computer science/train songs I looked forward to performing in the lectures. Most of these feature in the SEP story, but the one I originally expected to be the number with the biggest performance potential didn't make it in. I had heard of a song called Casey Jones, about an American railway engineer and the tragic trip in which he died. There was a piece by that name in a piano book, but I couldn't find words on the internet which matched the music I had. The overture, which I didn't write until Dec 00, used a theme derived from that music. It was my first attempt at orchestral composition with MIDI. As the main part of KoC was set in the second semester of 99 (Aug - Nov) the overture is a musical representation of my life in June and July.

1. The Salutation, written when I was writing the script, sung unaccompanied by the chorus.
2. This song is adapted from Alice Childress, by Ben Folds Five. It was originally going to be sung by Bob, but Bob already has a song to himself, the song is too high for a bass, and there weren't enough female parts with solos, so for want of a better solution, an alto sings the song on Bob's behalf. Every other song in the show has vocal parts typed out, but the syncopated nature and length of the song makes it impractical to type up in the usual manner, so the tune of this song is defined by the original. In the 1st and 3rd lines of each refrain, some of the chorus sing the last two words. Some of the chorus also sing the line "Substitution cipher is not so good". These chorus lines are printed in the score.
3. The Train Don't Stop, a quartet sung unaccompanied by the software engineers, written before the script.
4. The Vignere cipher song, sung by Alice, Bob and the chorus, uses a tune I wrote in 1995.
5. Kokomo, by the Beach Boys, becomes CoCoMo which the software engineers sing, denouncing the use of the Constructive Cost Model for their Project. After listening to the CD at length trying to transcribe it I gave up and found Alan Doane's transcription, which I used heavily. I had trouble believing that they would use entire major chords a semitone apart consecutively.
6. The Hill cipher scene, with Alice, Bob and the chorus - written well after the script.
7. Assignment Three - a quartet by the software engineers.
8. Bob's Public Key song - written when I was writing the script.
9. The All-nighter - another quartet by the software engineers, written after the script.
10. Kiss Me by Sixpence None the Richer was a very popular song in 1999. It incurs lyrical change to become It's Me, which Alice sings upon development of her cryptographical signature. This song uses a karaoke track.

11. The Cat of the Railway Train from the musical CATS (by T.S.Elliot and Andrew Lloyd Webber) is changed to become The Program of the railway train, sung by the Software Engineers and the chorus after their initial demonstration. The first part of the original song remains with relatively little changed. The unique 13:8 time signature is there, although Cakewalk was grouping the quavers wrongly, so the bars had to be broken up.

12. Say it Thrice - the Noise song sung by Alice, Bob and the chorus, written in early 02.

13. Runaway Train, by Soul Asylum, was changed around for the song sung by Rod lamenting an unsuccessful final demonstration.

14. The Finale, sung by the whole cast, uses a tune I wrote in 1993 and two other themes. I wrote it in early 03, lost it in a hard disk accident and reconstructed it later from a reduced printout.

Music files:

The full set of music & other files for KoC can be found at website (<http://users.chariot.net.au/~theloves>). It includes a PDF of the libretto and vocal score (which is probably what you are reading), the performance MIDI files which contain the accompaniment, the full MIDI versions of most of the songs (for learning how they go) and the MP3 track for no.10. The MIDI for no.2 was transcribed by Chris Cottam.

Also on my website is my email address and I welcome any feedback. If my site isn't there in the future, searching on some appropriate keywords may find it elsewhere. There aren't yet any recordings of any of KoC. As far as I know, none of it has been performed apart from two quartets (both at my uni and at a high school in Melbourne). I hope that in the future some singers take it upon themselves to perform or record some of it, and I hope to see it live or on YouTube.

More words of explanation:

Often there are long notes without any notes attached to them. They're meant to be "ah" or some such vowel sound. The three unaccompanied quartets all end with one or more singers having two notes on the last word – there is meant to be a slide from one to the other. The full MIDI tracks have a boring guitar part (plain chords were easiest to put in). Greg can strum the chords in whatever manner seems right.

MIDI was a medium of choice not only because I was using Cakewalk, but because at the time it was an advantage to keep files small. KoC was conceived in the days of floppy disks and largely written in the days of dial-up internet and restricted webspace. Likewise, I laboured to keep the number of pages to a minimum, often lamenting Cakewalk's lack of printing options. Don't even look at the page numbers – each number was printed to an individual PDF.

I wrote for performers like myself at – able to read music and sing in tune but not that confident. There were not as many as I thought in that category. I kept the vocal ranges fairly small in most cases, in particular the alto part only goes up to A, unlike altos in the classical repertoire (this allows tenors to sing the part). Bass notes that are too low can be lifted an octave. Alex's top notes can be in falsetto, but as some of those songs are unaccompanied, they can be shifted up or down to suit the singers. The other potentially hard thing for Alex is that the constraints of four-part male harmony leave him above middle C for long periods. (Having a female Alex of course is an option). Pete's high E's in no.11 can be spoken, and any other notes that might stretch anyone's range are hidden away in 4-part territory.

I didn't realise that there weren't many singers in my category. Most people who could read music and sing in tune were quite confident, and had bigger ranges than KoC required, but still might have trouble with complicated music – Pete in particular is a smallish part with a small range, but has difficult harmony lines to follow, and the four chorus parts are often similar.

I envisaged a performance in the Kerr Grant lecture theatre, with characters coming in and out of the doors, Oscar's thugs sitting at the back wheeling their bin through the back door, the chorus jumping on the desk at

some point. Choreography was never my thing, so I never thought much in that area, although most directors would. As for costume, I imagined that a cast of uni students would dress like uni students. The software engineers have costume directions in numbers 5, 9 and 13, so they could have up to six costume changes although some of these need only be token.

The word crash is used in three meanings (two of which appear in one line). One refers to a train collision and in computing, a program is said to crash if it fails when it is running or starting to, while to crash a task in a software project (not a common usage) is to complete it in less time than it takes, something which rarely happens without a looming deadline. In No.5, a KLOC means a thousands lines of code. David Knight was a much-loved computer science tutor, regarded as worth more than many of his colleagues combined. There are no doubt other terms which will be foreign to anyone unfamiliar with software engineering, cryptology and Adelaide Uni.

THE SCRIPT

The Overture is played.

The Chorus comes on singing No.1:

Hello! Hello! Hello! Hello!

Welcome to this theatre in which we'll do our show

Studies mathematical don't often bring along

Circumstance dramatical and worthy of a song

Hark as we give voice and words boring guys with brains

A story of computer nerds, cryptologists and trains

Enter the Software Engineers.

Quartet: People get ready, there's a train a-coming

MC: What's all this about?

Rod: In our project we will develop software which controls a train set. Because of the availability of songs about trains, you're going to hear such a song every time you see us.

Exit the Software Engineers.

Enter Alice, Bob and Oscar.

MC: We're going to follow them through the semester as they do their project. We're also going to see the simple story of cryptology. We have Alice, who sends messages to Bob. The way she sends them doesn't matter. But Oscar somehow has access to all the messages and likes to eavesdrop, while Alice and Bob don't appreciate that. So they have resorted to cryptology.

Bob: We have to periodically work out an encryption function for her to use and a decryption function for me, neither of which Oscar can know about. So I have to send this week's encryption function to Alice by Courier. Courier!

The Courier goes to Bob, takes a piece of paper from him to Alice and returns.

Alice: We are using a substitution cipher, which means every letter of the alphabet is replaced by a different one.

Bob: Oscar challenged Alice to send a message using the word CROSS-SECTION, saying that on interception he would immediately be able to crack it.

The message appears on the screen and Oscar begins to deduce the plaintext.

Oscar: Aha! Cross-section has three S's in a row! From that I'll be able to find C, E, I, N, R, S and T and then I'll be able to work out the whole thing!

Oscar exits triumphantly. Bob and Alice are disappointed.

The music for No.2 begins.

Bob: Ben's written this song too high for me. One of you can sing it.

An alto from the chorus sings, the chorus coming in for the words in bold.

Alice, this cryptosystem really was a bad one
We thought it was secure, Oscar showed us otherwise
But in one lecture soon we'll learn to use a good one
Which he can't analyse
He can't analyse

He won't be able to decipher what **you send**
He'll never be a problem any more
He won't be able to decipher what **you send**
Any more, no, not any more

Oscar's method of attack was based upon some plaintext
He had a clue about a word that you were going to send
Don't eat his bait and take a challenge when you see him next
We'll beat him in the end
Beat him in the end

Keep going to lectures and we'll learn a **better way**
Oscar won't be a problem any more
He won't be able to decipher what **you say**
Any more, no, not any more

No it didn't work out
No it didn't work out the way we thought it would
No it didn't work out
(Chorus: Substitution cipher is not so good)

Alice, we've only had two lectures for this subject
There's so much more to learn which leaves this cipher nowhere near
Not long till we learn a system that is perfect
There'll nothing left to fear
Nothing left to fear

Dr Clarke has promised Oscar's day **will end**
Far better cryptosystems are in store
Which will ensure he won't decipher what **you send**
Any more, no, not any more
Any more, no, not any more

Exit Alice, Bob and Oscar.
Enter the Software Engineers.

MC: Here are those software engineers again. So what's this train set you have to control.

Rod: The program we produce has to safely control five trains on a model of the Belair train line.

Pete: The model is a simplified version of the real one, with only five stations. The real line has itself been simplified by the closure of three stations and a lot of people were unhappy about it.

No. 3 - Quartet:

The train don't stop at Millswood no more
Or the students at the orphanage would catch it there for sure
One lady died there waiting, now they've put a sign there stating
That the he train don't stop at Millswood no more

The train don't stop at Hawthorn no more
train_interface.ads is different from before
All TransAdelaide could say was "Unley Park's not far away"
Cos the train don't stop at Hawthorn no more

The train don't stop at Clapham no more
If we attempt to stop it we'll have trouble with the law
Along Springbank Road they're sad [but further up they're glad]
That the train don't stop at Clapham no more
No, the train don't stop at Clapham or Hawthorn or Millswood no more

MC: Hey, why don't you sing?

Greg: I choose not to sing.

MC: Can you do anything that makes it worth you coming along with these guys?

Greg: I can play the guitar.

MC: Good. Bring that along next time.

**Exit the software engineers.
Enter Alice, Bob and Oscar.**

No. 4

Bob:

I've been to the crypto lecture where we have learnt the Vigenere cipher
and we're about to use it now

Chorus: Off you go, let's see how

Alice: Dr Clarke explained it skilfully, I am now encrypting carefully
And I'm going to send it now

Chorus:

Message sent, off it goes
Will Oscar crack it, no one knows
Could this really be unbreakable, if so Oscar soon will look a fool
O, what kind of crypto-attack is it going to be
And is it going to work, we'll wait and see

Bob: This week we are using a Vignere cipher. Alice enciphers her message using this word which I will give her as the key. I will decipher it in a similar manner. Courier!

The Courier runs over to Bob, takes the word and starts running around towards Alice.

Oscar: Thugs!

The Thugs gets in the Courier's way, pull him to the ground, take the paper from him, pick him up and put him in the bin. Thug1 wheels the bin outside with the Courier in it then goes to Oscar, mumbles into his ear as Oscar gives him some money. Thug2 takes the paper to Alice.

Alice: Where's the usual Courier?

Thug2: He's bin put out.

Alice: Weely?

Alice and Bob exit.

Oscar: I've outsmarted them this time, and I'll do it again next time.

Oscar and the Thugs leave.

Enter the Software Engineers, in beach attire. Greg has his guitar.

MC: Hello again. How's it going?

Pete: We've just been learning about how to estimate the cost of a project, in time, money and people, using the Constructive Cost Model, or CoCoMo for short.

MC: You look like you're on your way to the beach and you're talking about CoCoMo - I think I can see where this is heading.

Thug1 wheels the bin back in, this time with Oscar hidden in it, and leaves.

Nick: But I think in the case of our project, we have to do it, we've been given a time frame to work in, our groups are chosen and we don't have a budget. So there's no use counting up how long it's going to take.

No.5

Pete: I don't know how many KLOCs to start the sum with
Experience is something this group doesn't come with
The virtual machine is anybody's guess. We don't know-

Nick: A few days ago
We learnt about CoCoMo
A way of finding out how long your project's gonna go
But we've made up our mind
That's something we don't care to find
We're gonna do this thing blind
To knowing of the size of the kind
Of project we've been assigned

Quartet: A workplace may value an evaluation
To know what is needed is worthwhile information
Which ought to be heeded

Alex: Ooh, and that's the reason they use CoCoMo
So they don't find too late their budget's low
Or that their team needs to grow
Or has too many in tow

Nick: We don't decide which train we're gonna ride

Pete: With each multiplier
You find how much time you require
How many people to hire
But in our case we can't have what we desire
If we have too few
We can't employ a bigger crew
Nor decide the whole thing's too hard to do
We gotta see it through
And have it ready when due

Quartet: Though later it's likely that our jobs will make us
Take measures to find out how long things will take us
Our timeframe is fixed so

Alex: Ooh, we won't waste time by using CoCoMo
The deadline's set, we wanna have it met
We probably don't have time to go
And play with CoCoMo

Nick: Oh why did we sign up for SEP?

Pete: In quantum physics strange
Rules govern whereby you might change
A variable in the act of measuring it, somewhere in Heisenberg's range

Alex & Rod (waving hands mysteriously): Doo doo doo doo doo doo doo

Pete: But one must confess
That if we have a proper guess
At the cost (of giving the Belair express
Software which won't fail to impress)
We can't thus make the total be less

Quartet: We know the requirements to which we are committed
If time's short the whistles & bells will be omitted
We're set now and we know

Alex: Ooh, we've got no reason to use CoCoMo
We'll crash all tasks till we can take it slow
That's why we wanna throw
Away the CoCoMo

The Software Engineers leave as Alice and Bob enter from different sides.

Bob: Oscar beat us last time, but Dr Clarke's taught us another cipher we can use.

MC: Hey Bob, Dr Clarke's first name is also Bob, isn't it?

No. 6

Bob: From someone else called Bob I have learnt a thing or two

Alice:
In cryptology we've seen a lot in this semester
Of all the methods I have been, with Bob, an able tester

With Oscar now so devious we needed a stronger still cipher
In the lecture previous we learnt to use the Hill cipher

Chorus:

They have a stronger still cipher; they've learnt to use the Hill cipher

Bob:

Last time the Courier took our key but Oscar had him beat up
To be more careful this time we decided we would meet up

Bob and Alice meet by the bin. Bob gives Alice the piece of paper and she studies it.

Bob:

Here's the transformation matrix, quickly memorise it
Destroy the information to ensure that no one spies it

Alice rips the paper in half and drops it in the bin. Alice and Bob go to their opposite sides again.

Alice:

For the Hill cipher the key is a matrix, two by two
Invertible it must be, now watch what we will do
I break my message into twos and multiply each pair
This method isn't hard to use - the ciphertext is there

Chorus:

This method isn't hard to use, you break your message into twos
Multiply each pair and the ciphertext is there

Bob:

The matrix that I use is the one inverse to hers
Which is why we have to choose a matrix which has an inverse
I multiply the vectors back to how they were, and then
Alice's plaintext is as she wrote it once again

Alice & Bob:

Our medium is insecure but we believe we've found the cure
Though Oscar may eavesdrop 'till next summer's leaves drop
And process all he hears on his computer for two years
None of his great tricks will give him our matrix
If you want it stronger, make the matrix bigger
Make the vectors longer, it's harder then to figure

Chorus:

If you want it stronger, make the vectors longer
Make the matrix bigger, it's harder then to figure
Their medium is insecure but they believe they have the cure
Though Oscar may eavesdrop till next summer's leaves drop
And process all he hears on his computer for two years
None of his great tricks will give him our matrix

Alice & Bob exit triumphantly. Oscar bursts out of the bin with a triumphant cry.

Oscar: From someone else called Oscar I have learnt a thing or two.

Oscar gets out of the bin and exits as the Software Engineers enter again.

MC: Hello again. Are you keeping up with your project?

Alex: Yeah, nah, we haven't done much yet.

Greg: I foresee some problems occurring later on because of a habit to which few computer science students are immune.

Pete: We all think we such good programmers that we can achieve anything in the last twenty percent of the time we are given to do it. Hence there is no reason not to procrastinate. However, we are not always capable of all that we believe we are. We compiled this song in second year after discovering this for ourselves.

No.7 - Quartet:

I have eight days to do Assignment Three
Sure looks like a piece of cake [to me]
[I worked the] algorithm out, you just couldn't get it wrong
The coding will be easy and it won't take very long

I have two days to do Assignment Three
It's not quite as easy as I thought it would be
There are bugs all through and I just can't get it right
I'm going to pay a visit to my good friend David Knight

I have just handed in Assignment Three
When the input's wrong [it crashes instantly]
'Twas badly done, to improve my score
I'll have to do better in Assignment Four

MC: Why don't you put some long hours into your project earlier, if you know you're not as good as you think we are.

Alex: Yeah, nah, we still think we're better than we are.

MC looks confused.

Pete: And it's easier to talk about our problems than to actually do something about them.

Exit the Software Engineers. Enter Bob.

Bob: I've decided how to make sure Alice's messages to me are never read by anyone else.

MC: What sort of system are you using now?

Bob: Public key cryptography! I've made the encryption function public, but to use it to work out the private decryption function would require the use of a very fast computer for over a week.

No.8

In the lectures Dr Clarke gave us the trick
A cryptosystem that will give Oscar the flick

Chorus: A cryptosystem that will give Oscar the flick

Bob: With no fear Alice can send to me
Whatever she wants with my public key

Chorus: What ever she wants with his public key

Bob: This new cryptosystem defies analysis
Might I say, I'm such a genius

The Chorus choose not to repeat Bob's line. Enter Oscar.

Bob: I mean Dr Clarke's such a genius

Chorus: I mean Dr Clarke's such a genius

Bob, singing at Oscar's face:

Public key cryptology!

I've sabotaged Oscar's plans with my public key

Chorus: He's sabotaged Oscar's plans with his public key

Bob: Oscar knows that he has lost the fight
Just as long as my private key's out of sight

Chorus: Just as long as his private key's out of sight

Bob: Oscar doesn't have a chance

Oscar: I don't agree

Bob: What are you going to do about my public key?

Chorus: What are you going to do about his public key?

Oscar: You'll see.

Bob, discovering a long list of messages sent by Alice: Now, what's Alice sent me today? What? How many messages did she send me?

Oscar: Only one. Which one do you think it is?

Bob: I know Alice well. I should know a message from her when I see one. I've seen plenty of them.

Oscar: So have I. Messages from Alice is my favourite genre.

Enter the Software Engineers wearing pyjamas.

Exit Bob and Oscar.

MC: You guys are unusually dressed for uni.

Alex: Yeah, nah, we've been working all evening and we're going to sleep here overnight.

No. 9 - Quartet:

We've worked here all day and we'll stay here all night

Keep coding till two and then sleep [well we might]

We're trashing our bodies and mashing our brains

In crashing this task so we don't crash our trains

We've worked here all day and we'll soon sleep tonight

[But] in the CATS suite you can't turn off the light

But sleeping is not a hard thing to do

When you've worked half the night and the clock says it's two.

We've worked here all day and we'll stay here all night

Some other groups have been equally bright
Leaving the work till the deadline was near
Now doing an all-nighter with us in here

Enter Greg, holding a printout.

Greg:

This just in, a requirements change
And I fear that this may be out of our range
The software we now are required to arrange
Must control the trains on the train line to Grange!

Quartet: No!

We've worked here all day and we'll work through the night
This last piece of news has come as a fright
Our lifestyle this week is making us tired
But a few more all-nighters we think are required

Pete: Hang on, why would Fred put a message on the bulletin board this late?

Greg: I had you going there for twenty four seconds.

Nick: Stacks on!

Greg is stacked upon. Exit the software engineers.

Enter Alice.

Alice: I've solved the problem of Oscar's forgeries. If I sign my messages, using a private key to encrypt a signature with the date and time, anyone can decrypt it and see that the message is from me as long as the time and date are recent enough. All Oscar can do is copy a signature, which would then be out of date.

MC: Well, are you going to sing a song about it?

Alice sings No.10:

It's me; this signature is mine
Use my key, decrypt it check the time
You should see that it's not out of date
Ignore this message if it's at all late

Oh, it's me; Oscar could not have sent this
Believe me, a genuine it is
Read this message though
A forgery would be as hard as finding out your private key
'Cos it's me

It's me; no one can sign this way
But me, so I can finally say
Safely, whatever I like
You can tell Oscar to get on his bike

Oh, it's me; Oscar could not have sent this
Believe me, a genuine it is
Read this message though
A forgery would be as hard as finding out your private key
Cos it's me

Oscar: I s'pose that's the end of me then. I'd better try and leave with some dignity.

Oscar starts to leave and trips over.

Oscar: And I couldn't even do that.

Oscar gets up and leaves.

Enter the software engineers, Greg with his guitar.

MC: Here are the software engineers, who have just given their initial demonstration. Did it go well?

Alex: Yeah, nah, it went OK.

No. 11

Quartet:

There's a whisper down the line at eleven thirty nine
The Belair train's ready to depart
But we've lost the disk with the initialising file
The Belair train just can't start
All our friends who are in sight (and if we're desperate, David Knight)
Will be searching high and low
Saying "we can't go a mile without the startup file"
The Belair train just can't go
At eleven forty two with the signal overdue
And we engineers all frantic to a man
It was in my other pocket so there wasn't any need to go
And type it in the code by hand
And then we got it loading saving us a lot of coding
And the signal went "All clear"
And we're off at last, soon to qualify
As a software engineer

Chorus: They have made, in S.E.P., the program of the railway train!

Alex: You might say by and large that our program was in charge
Of the Adelaide-Belair express

Rod: From the engine driver function to the switches at each junction
It would supervise them all more or less

Pete: It asserts each switch is set and requirements are met
By reserving sections of track

Nick: It established control by a regular patrol
And would know at once if Fred had changed one back

All: We/They safely passed though Goodwood and then Mitcham and then
Blackwood

The imaginary passengers inside
Enjoyed the express service, there was no need to be nervous
On their simulated half-hour ride
Trains will stop at every station in the final demonstration
When Fred and Michael see them/us again

Quartet:

There will be no suspense when we come back one month hence
With the program of the railway train

Chorus: With thirteen quavers in every bar, courtesy of Andrew Lloyd
Webber, we now conclude singing of the program of the railway train

MC: Well they're happy now. Let's hope their final demonstration goes
equally well.

Quartet:

And we're off at last, soon to qualify
As a software engineer!

Exit the Software Engineers.

Enter Alice and Bob.

Alice: Oscar has gone, but now a new challenge faces us. Instead of sending messages through an insecure medium, we have a noisy medium.

Bob: We now have to add redundancy to our messages to allow us to understand them when some of the data has been garbled.

Alice: One simple method of doing this is to send the message three times. It is almost impossible for the same part of a message to be destroyed twice out of three.

No. 12

Chorus: Noise, noise, noise, noise, noise, noise, noise, noise, noise,
noise, noise

Alice: Oscar is gone, no more problems with security

Bob: But with the noisy medium now, our problem is clarity

Alice & Bob: There's a way to send a message, it will work, we guarantee

Chorus:

Say it thrice! Say it thrice! Say it thrice!
Noise, noise, noise, noise, noise as loud can be
Noise, noise, noise, noise, in the key of C

Alice:

Tell me, can you hear me Bob?
Is triple repetition really doing its job?
This code's no good if twice from three
The noise is such that you mis-hear me

Chorus:

Noise, noise, more noise, with variety
Noise, noise, lots of noise, noise in harmony

Alice: Tell me, can you hear me Bob....

Chorus:

Noise, noise, more noise, drown out every word
Noise, noise, lots of noise, Alice can't be heard

Alice: Tell me, can you hear me Bob....

Bob:

I heard you Alice, every word came through
Triple repetition really does the trick with you
And as the noise has stopped I needn't sing this verse twice more
And we'll revert to six-eight time, we'd changed it to four four

Chorus: Noise, noise

Alice: Triple repetition is the code which saved the day

Bob: Despite the noise I was able to hear all that Alice had to say

Alice & Bob: We communicated though the medium was malicious

Chorus: Hey!
Say it thrice! Say it thrice! Say it thrice!

Exit Alice and Bob.

Enter the Software Engineers, wearing suits and Greg with his guitar.

MC: All ready for the final demo?

Greg: We just had it.

MC: Did your trains run OK?

Alex: Yeah, nah, we were asked to do the afternoon service, so we set our program going and watched the trains move into position. When the passengers came, our trains picked them up and started going like they were supposed to.

Pete: But then one of them looked like it was going the wrong way. I looked at the screen and saw that the program thought that train was somewhere else. We couldn't continue, so I clicked the emergency stop button.

No.13: Rod sings as Greg plays the guitar:

The train was lost, it had missed its destination
And kept going towards the next station
An empty train was waiting there
But the runaway train didn't seem to care

Runaway train never coming back
Wrong way on a one way track
On the track it was going somewhere
But on the screen neither here nor there
The Emergency Stop we requested
Didn't take effect although we'd tested
it In fact, we'd tested everything

The train wrecked, two hundred people dead
I didn't get much sympathy from Fred
If I could do it all again
I'd do all I could to stop a runaway train

Pete: Then I looked at the screen again.

The screen displays a window asking "Do you really want to execute an Emergency Stop?"

Rod: There were a hundred kids on that train!
Exit the Software Engineers.

Nick, returning: Can I have a drink?

MC gives him a can of drink and he leaves. Enter the chorus.

No. 14 - Finale

Solo: When Term Four's done a uni student
Postpones fun if he is prudent
Gets his books and has a read
Becoming a student indeed

He goes through quite a chaste time
During which he will not waste time
It's a study-study haste time!
And even practicalities of his course which are interesting
Aren't worth any discourse if they're not for testing
In November, in reality, for such a practicality
To interest one much is rare for certain
But against the general law are two cases that we saw
And we'll revisit 'ere we draw the curtain

Enter Alice and Bob.

Alice: In Coding and Cryptology we took a large anthology
Of notes about security and message signal purity
Just in case you hadn't seen, Bob and I were very keen
To get a system working where in spite of Oscar lurking
We'd have safe communication
From unauthorised translation

Chorus: We saw them get a system working
Where in spite of Oscar lurking
They had safe communication

Bob: Though Oscar tried his worst by the end he couldn't stop her

Oscar: May I remind you that at first,
I cracked your ciphers good and proper!

Bob: That the ciphers of mine and Alice's
Didn't stand up to Oscar's cryptanalysis
Matters little to our final grade, I am
Aware that Quinn and Clarke told us that our final mark
Would come eighty-five percent from the exam

Therefore may I mention, that because we paid attention
Whenever Clarke or Quinn spoke to the class

Alice & Bob: And we studied this stuff more
Than all the other ones I'm sure
So I think this subject we will pass

Solo: To sing in such a field as pure maths seems avant-garde
One has a heavy pen to wield; the rhyming's very hard
The poet has to play tricks and manipulate the main text
To make rhymes for words like matrix,
Cipher, eavesdropping and plaintext

Courier: I was looking for a word to rhyme
With Courier, at length I tried

The one I got won't do this time
That mathematics is Applied!

Solo: In less than scientific fields it's easier for you
You find the general language yields a synonym or two
But it's not the hardest thing to ask to put some maths to verse
In chemistry I'm sure the task would be a great deal worse

Enter Greg, playing the guitar, and Rod, singing:
All semester, I believe
My life was all about the project
Now I'm trying to conceive
What life was like without the project
I worked so hard, at the expense
Of all my other studies
Yes, this semester was intense
For me and these, my buddies

The other software engineers enter and sing in quartet:
We could have been much smarter
And planned our testing sessions
And analysed the test log data
Instead of resting sessions
In reference to our final grade
It won't matter how our project went
In the method our marks are made,
The exam's worth seventy percent

Chorus: They will keep on coding even after year's close
While knowledge is eroding of these things in minds of those
Who never really needed it but only really heeded it
To pass exams, as everybody knows

All: Everything we cram into our heads in November
Is there for the exam but is gone by December
But what you've seen us study here
Is learnt by heart to never fear
We will remember
We will remember

THE END

No.1 - Salutation

from Keep on Coding

Eric Love

1

1: Chorus S Hel - lo Hel - lo Hel - lo Hel - lo Wel - come to this the - a - tre in which we'll do our show

2: Chorus MA Hel - lo Hel - lo Hel - lo Hel - lo Wel - come to this the - a - tre in which we'll do our show

3: Chorus B Hel - lo Hel - lo Hel - lo Hel - lo Wel - come to this the - a - tre in which we'll do our show

10

1: Chorus S Stu - dies ma - the - ma - ti - cal don't of - ten bring a - long Cir - cum - stance dra - ma - ti - cal and wor - thy of a song

2: Chorus MA Stu - dies ma - the - ma - ti - cal don't of - ten bring a - long Cir - cum - stance dra - ma - ti - cal and wor - thy of a song

3: Chorus B Stud - ies ma - the - ma - ti - cal don't of - ten bring a - long Cir - cum - stance dra - ma - ti - cal and wor - thy of a song

18

1: Chorus S Hark as we give voice and words to bor - ing guys with brains A sto - ry of com - pu - ter nerds, cryp - to - lo - gists and trains Hel -

2: Chorus MA Hark as we give voice and words to bor - ing guys with brains A sto - ry of com - pu - ter nerds, cryp - to - lo - gists and trains

3: Chorus B Hark as we give voice and words to bor - ing guys with brains A sto - ry of com - pu - ter nerds, cryp - to - lo - gists and trains Hel -

26

1: Chorus
S lo Hel - lo Hel - lo Hel - lo Wel - come to this the - a - tre in which we'll do our show

2: Chorus
MA Stu-dies ma-the - ma - ti - cal don't of - ten bing a - long Much cir - cum-stance dra - ma - ti - cal and wor - thy of a song So

3: Chorus
B lo Hel - lo Hel - lo Hel - lo Wel - come to this the - a - tre in which we'll do our show

34

1: Chorus
S Stu-dies ma-the - ma - ti - cal don't of - ten bing a - long Cir - cum-stance dra - ma - ti - cal and wor - thy of a song

2: Chorus
MA hark as we give voice and words to bor - ing guys with brains A sto - ry of com - pu - ter nerds, cryp - to - lo - gists and trains Hel -

3: Chorus
B Stu-dies ma-the - ma - ti - cal don't of - ten bing a - long Cir - cum-stance dra - ma - ti - cal and wor - thy of a song

42

1: Chorus
S Hark as we give voice and words to bor - ing guys with brains A sto - ry of com - pu - ter nerds, cryp - to - lo - gists and trains

2: Chorus
MA lo Hel - lo Hel - lo Hel - lo And wel - come to this the - a - tre in which we'll do our show

3: Chorus
B Hark as we give voice and words to bor - ing guys with brains A sto - ry of com - pu - ter nerds, cryp - to - lo - gists and trains

Nos. 1a & 2

from Keep on Coding

1a orig by Curtis Mayfield, 2 orig by Ben Folds Five, Koc by Eric Love

1

1: Chorus *No 1a: Interrupted Quartet*

2: 8 Peo - ple get rea - dy There's a train a - com - in'
Alex & Rod

3: Pete & Nick
rea - dy There's a train a - com - in'

5

1: Chorus *Part of No.2, occurs six times* * You send * 3rd time only
Chorus

2: 8 He won't be ab - le to de - ci - pher what you send
Solo (different words some times)

3: Pete & Nick

9

1: Chorus *another part of No.2* Sub - sti - tu - tion ci - pher is not so good
chorus

2: 8 No it did - n't work out
solo

3: Pete & Nick

No.3 - Quartet (The Train Don't Stop)

from Keep on Coding

Eric Love

1
 1: 8 Alex The train don't stop at Mills-wood no more____ or the stu-dents at the or-phan-age would catch it there for sure One

2: Rod The train don't stop at Mills-wood no more____ or the stu-dents at the or-phan-age would catch it there for sure One

3: Pete & Nick The train don't stop at Mills-wood no more____ or the stu-dents at the or-phan-age would catch it there for sure One

6
 1: 8 Alex la - dy died there wait - ing, now they've put a sign there sta - ting that the train don't stop at Mills - wood no more____ The

2: Rod la - dy died there wait - ing, now they've put a sign there sta - ting that the train don't stop at Mills - wood no more____ The

3: Pete & Nick la - dy died there wait - ing, now they've put a sign there sta - ting that the train don't stop at Mills - wood no more____ The

10
 1: 8 Alex train don't stop at Haw - thorn no more____ Train In - ter - face dot A D S is dif - rent from be - fore All Trans -

2: Rod train don't stop at Haw - thorn no more____ Train In - ter - face dot A D S is dif - rent from be - fore All Trans -

3: Pete & Nick train don't stop at Haw - thorn no more____ Train In - ter - face dot A D S is dif - rent from be - fore All Trans -

14

1:  Alex A - de - laide could say was "Un - ley Park's not far a - way" 'cos the train don't stop at Haw-thorn no more. The

2:  Rod A - de - laide could say was "Un - ley Park's not far a - way" 'cos the train don't stop at Haw-thorn no more. The

3:  Pete & Nick A - de - laide could say was "Un - ley Park's not far a - way" 'cos the train don't stop at Haw-thorn no more. The

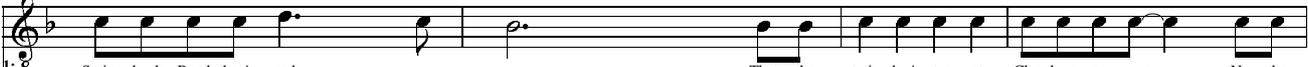
19

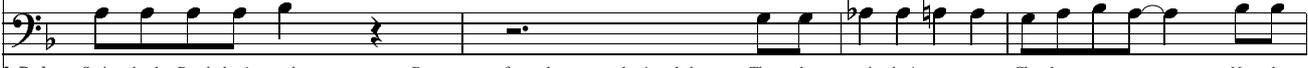
1:  Alex train don't stop at Clap - ham no more. If we at - tempt to stop it we'll have trou - ble with the law A - long

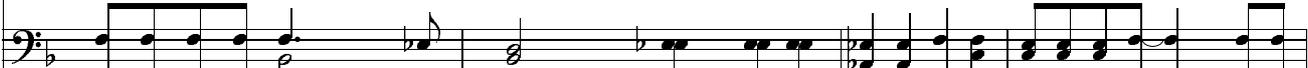
2:  Rod train don't stop at Clap - ham no more. If we at - tempt to stop at we'll have trou - ble with the law A - long

3:  Pete & Nick train don't stop at Clap - ham no more. If we at - tempt to stop it we'll have trou - ble with the law A - long

23

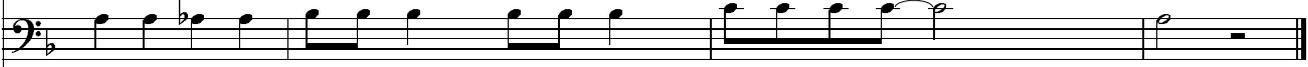
1:  Alex Spring - bank Road they're sad. That the train don't stop at Clap-ham no more. No, the

2:  Rod Spring - bank Road they're sad. But fur - ther up they're glad. That the train don't stop at Clap-ham no more. No, the
(spoken)

3:  Pete & Nick Spring - bank Road they're sad. That the train don't stop at Clap-ham no more. No, the

27

1:  Alex train don't stop at Clap - ham or Haw - thorn or Mills - wood no more.

2:  Rod train don't stop at Clap - ham or Haw - thorn or Mills - wood no more.

3:  Pete & Nick train don't stop at Clap - ham or Haw - thorn or Mills - wood no more.

No.4 - Vignere cipher song

from Keep on Coding

Eric Love

1

3:

4:

Bob

I've been to the cryp - to' lec - ture Where we have learnt the Vig - nere

5: Strings

12

3:

Doc - tor Clarke ex - plained it

Alice

4:

ci - pher And I'm ab - out to use it now. Off you go Let's see how

chorus AB

5: Strings

24

3:

skil - ful - ly, I am now en - cryp - ting care - ful - ly And I'm going to send it now Mes - sage sent! Off it goes

chorus SM

4:

Mes - sage sent! Off it goes

chorus AB

5: Strings

36

3: Will Os - car crack it, no - one knows _____ Could it real - ly

4: Will Os - car crack it, no - one knows _____ Could it real - ly

5: Strings

47

3: be un - break - ab - le? If so, Os - car soon will look a fool And what kind of cryp - to - at - tack is it going to

4: be un - break - ab - le? If so, Os - car soon will look a fool And what kind of cryp - to - at - tack is it going to

5: Strings

59

3: be? And is it going to work? We'll wait and see _____

4: be? And is it going to work? We'll wait and see _____

5: Strings

No.5 - Quartet (CoCoMo)

from Keep on Coding

orig. by the Beach Boys, KoC by Eric Love

1

108P1

11: P2 I don't know how ma - ny KLOCs to start the sum with Ex -

Pete

5

108P1

11: P2 per - ience is some - thing this group does - n't come with The vir - tual ma - chine is a -

8

108P1

11: P2 ny - bo - dy's guess We don't know/A few days a - go

Greg

Nick

12

108P1

11: P2 We learnt a - bout Co - Co - Mo A way of find - ing our how long your pro - ject's

16

108 P1 D7 G7 C Cmaj7

11: gon - na go — But we've made up our mind —

P2

20

108 P1 Gm F Fm

11: That's some - thing we don't care to find — We're gon - na do this thing blind —

P2

23

108 P1 C D7 G7 A

Alex & Rod

11: — To know - ing the size of the kind — Of pro - ject we've been as - signed

P2

26

108 P1 work - place may va - lue an — e - va - lu - a - tion To know what is need - ed Worth -

11: — may va - lue an — e - va - lu - a - tion To know what is need - ed Is worth -

P2

Pete & Nick

29

108 P1 while in - for - ma - tion Which ought to Ooh, — and that's the rea - son they use Co - Co - Mo — So

11: while in - for - ma - tion Which ought to be heed - ed How — long will it take ya?

P2

Alex

R / P / N

33

108 P1

they don't find too late their bud-get's low Or that their team needs to grow

11: P2

37

108 P1

Or has too ma-ny in tow

11: P2

We don't de-cide which train we're gon - na ride Use each mul - ti - plier

Nick *Pete*

41

108 P1

11: P2

Find out how much time you re - quire How ma - ny peo - ple to hire

45

108 P1

11: P2

But in our case we can't have what we de - sire If we have too few

Rod & Pete

50

108 P1

11: P2

We can't hire a big - ger crew Nor de - cide the whole thing's too hard

53

108 P1

Though
Alex & Rod

11: P2

— to do We got - ta see it through And have it rea - dy when due/Tho'

Pete Pete & Nick

56

108 P1

C C C F F

lat - er it's like - ly that — our jobs will make us (go) Take mea - sures to find out how —

(Greg plays on rests)

11: P2

lat - er It's like - ly that — our jobs will make us (go) Take mea - sures to find out how —

59

108 P1

F F C C

— long things will take us Our time - frame Ooh, — we won't waste time by us - ing

Alex

11: P2

— long things will take us Our time - frame is fixed so We — won't use Co - Co - Mo

R / P N

62

108 P1

Co - Co - Mo — The dead - line's set, — we wan - na have it met — We prob - ly don't — have

11: P2

66

10/8
P1

time to go_____ And play with Co - Co - Mo

Greg

11:
P2

Oh why did we sign up for S. E. P.?

Nick

70

10/8
P1

C Cmaj7 Gm F Fm C D7 G7

(saxophone solo)

11:
P2

78

10/8
P1

C

11:
P2

In quan - tum phy - sics strange_____ Rules go - vern where - by

Pete

81

10/8
P1

11:
P2

you might change_____ A va - ri - ab - le in the act of mea - sur - ing it_____ Some - where in

84

10/8
P1

Doo doo doo doo doo doo doo

Alex & Rod

11:
P2

Hei - sen - berg's range_____ But one must con - fess

88

108 P1

11: That if we have a pro-per guess— At the cost of giv-ing the Bel - air ex - press Soft - ware which won't
P2

92

108 P1

11: fail to im - press We can't thus make the to - tal be less/We know the Re - quire - ments to which—
P2

Alex & Rod

Pete & Nick

95

108 P1

11: — we are com - mit - ted— If time's short the whist - les and bells— will be o - mit - ted We're
P2 — we are com - mit - ted— If time's short the whist - les and bells— will be o - mit - ted We're

98

108 P1

11: set now Ooh, — we've got no rea - son to use Co - Co - Mo — Just crash all tasks — till we can
P2 set now and we know We — won't use Co - Co - Mo F Fm
R/P/N *Greg*

102

108 P1

11: take it slow — That's why — we wan - na throw — A - way the Co - Co - Mo
P2 C Am Dm G7

No. 6 - Hill Cipher Scene

from Keep on Coding

Eric Love

1 A D/A E/A A

1: Alice From some-one else called Bob I have learnt a thing or two

Bob, bass clef

6: Flute

10 A D E A D

1: Alice In cryp-to-lo-gy we've seen a lot in this se-mes-ter Of all the me-thods

Alice

6: Flute

18 G Bm E A D Bm

1: Alice I have been, with Bob, an a-ble tes-ter With Os-car now so de-vi-ous we need-ed a strong-er

Alice

6: Flute

24 F#m F#m B7 E A A

1: Alice still ci-pher In the lec-ture pre-vi-ous we learnt to use the Hill Ci-pher They have a strong-er

chorus SMA

6: Flute They have a strong-er

chorus B, bass clef:

68

1: Alice still ci-pher They've learnt to use the Hill Ci-pher
chorus

2: Bob still ci-pher They've learnt to use the Hill Ci-pher Last time the Cou-ri-er took our key but Os-car had him
chorus *Bob*

6: Flute

74

1: Alice

2: Bob beat up To be more care-ful this time we de-ci-ded we would meet up

6: Flute

83

1: Alice

2: Bob Here's the trans-form-a-tion mat-rix, quick-ly me-mo-rise it Des-troy the in-for-ma-tion to en-sure that no one spies it.

6: Flute

92

1: Alice For the Hill Ci-pher the key is a mat-rix, two by two In-ver-ti-ble it must be, now
Alice

2: Bob

6: Flute

101

1: Alice here is what we do I break my mes-sage in - to twos and mul - ti - ply each pair This me-thod is - n't hard to use, the ci - pher-text is

2: Bob

6: Flute

110

1: Alice there This me-thod is - n't hard to use, you break your mess - age in - to twos Mul - ti - ply each pair, and the ci - pher text is there
chorus

2: Bob This me-thod is - n't hard to use, you break your mess - age in - to twos Mul - ti - ply each pair, and the ci - pher text is there The
chorus Bob

6: Flute

119

1: Alice

2: Bob mat - rix that I use is the one in - verse to hers Which is why we have to choose a mat - rix which has an in - verse I mul - ti - ply the

6: Flute

128

1: Alice Our me - di - um is
Alice

2: Bob vec - tors back to how they were, and then A - lic - e's plain - text is how she wrote it once a - gain Our me - di - um is

6: Flute

136

1: Alice in - se - cure but we be - lieve we've found the cure Though Os - car may eaves - drop 'till next sum - mers leaves drop And

2: Bob in - se - cure but we be - lieve we've found the cure Though Os - car may eaves - drop 'till next sum - mers leaves drop And

6: Flute

143

1: Alice pro - cess all he hears on his com - put - er None of his great tricks will give him our mat - rix If you want it

2: Bob pro - cess all he hears on his com - put - er for two years None of his great tricks will give him our mat - rix If you want it

6: Flute

152

1: Alice strong - er, make the mat - rix big - ger Make the vec - tors long - er It's har - der then to fi - gure

2: Bob strong er, make the mat - rix big - ger Make the vec - tors long - er it's har - der then to fi - gure

6: Flute

(continues)

19

1: Alice

Make the mat - rix big - ger

2: Bob

It's har - der then to fi - gure

3: Chorus S

Their

4: Chorus MA

Make the mat - rix big - ger it's har - der then to fig - ure Their

5: Chorus B

If you want it strong - er Make the vec - tors long - er Their

27

1: Alice

2: Bob

We be - lieve we've found the cure

3: Chorus S

me - di - um is in - se - cure but they be - lieve they've found the cure Though Os - car may

4: Chorus MA

me - di - um is in - se - cure but they be - lieve they've found the cure Though Os - car may

5: Chorus B

me - di - um is in - se - cure but they be - lieve they've found the cure Though Os - car may

32

1: Alice We have learnt the Hill Ci-pher Crack it if you

2: Bob From some-one else called Bob I have learnt a thing or two

3: Chorus S eaves - drop 'till next sum-mer's leaves drop And pro-cess all he hears

4: Chorus MA eaves - drop 'till next sum-mer's leaves drop And pro-cess all he hears on his com - put - er for two years

5: Chorus B eaves - drop 'till next sum-mer's leaves drop on his com - put - er for two years

40

1: Alice will ci - pher! will give him our mat - - - rix

2: Bob will give him our mat - - - rix

3: Chorus S None of his great tricks will give him their mat - - - rix

4: Chorus MA None of his great tricks will give him their mat - - - rix

5: Chorus B None of his great tricks will give him their mat - - - rix

No.7 - Quartet (Assignment Three)

from Keep on Coding

Eric Love

1

1: 8 Alex I have eight days___ to do As - sign - ment Three___ Sure looks like a piece of

2: Rod I have eight days___ to do As - sign - ment Three___ Sure looks like a piece of

3: Pete & Nick I have eight days___ to do As - sign - ment Three___ Sure looks like a piece of

5

1: 8 Alex cake to me___ the al - go - ri - thm out, you just could - n't get it wrong The co - ding will be ea - sy and it

2: Rod cake I worked the al - go - ri - thm out, you just could - n't get it wrong The co - ding will be easy and it won't

3: Pete & Nick cake to me___ the al - go - ri - thm out you just could - n't get it wrong The co - ding will be ea - sy and it

9

1: 8 Alex won't take ve - ry long___ I have two days___ to do As - sign - ment Three___ It's

2: Rod take ve - ry long___ I have two days___ to do As - sign - ment Three___ It's

3: Pete & Nick won't take ve - ry long___ I have two days___ to do As - sign - ment Three___ It's

The musical score is written for three voices: Alex (soprano), Rod (alto), and Pete & Nick (bass). It is in 4/4 time and features a key signature of one sharp (F#). The lyrics are a humorous take on programming, with Alex and Rod having a conversation about an 8-day deadline for 'Assignment Three' and the ease of coding. Pete and Nick provide a supporting bass line. The score is divided into three systems, with measure numbers 1, 5, and 9 marking the beginning of each system.

13

1: 8 Alex not quite as ea - sy as I thought it would be — There are bugs all through and I just can't get it right I'm

2: Rod not quite as ea - sy as I thought it would be — There are bugs all through and I just can't get it right I'm

3: Pete & Nick not quite as ea - sy as I thought it would be — There are bugs all through and I just can't get it right I'm

17

1: 8 Alex going to pay a vi - sit to my good friend Da - vid Knight — I have just han - ded in As -

2: Rod going to pay a vi - sit to my good friend Da - vid Knight — I have just han - ded in As -

3: Pete & Nick going to pay a vi - sit to my good friend Da - vid Knight — I have just han - ded in As -

21

1: 8 Alex sign - ment Three When the in - put's wrong — 'Twas bad - ly done, to im -

2: Rod sign - ment Three — When the in - put's wrong it crashes instantly! 'Twas ba - ly done, to im -
(spoken)

3: Pete & Nick sign - ment Three — when the in - put's wrong — 'Twas bad - ly done, to im -

25

1: 8 Alex prove my score I'll have to do bet - ter in As - sign - ment Four —

2: Rod prove my score I'll have to do bet - ter in As - sign - ment Four —

3: Pete & Nick prove my score I'll have to do bet - ter in As - sign - ment Four —

No.8 - Bob's song

from Keep on Coding

Eric Love

1

1: Bob

2: Ch_SM, accomp

3: Ch_AB, Strings

8

1: Bob In a lec - ture Doc - tor Clarke gave us the trick A cryp - to - sys - tem that will

2: Ch_Sl accom

3: Ch_A String

15

1: Bob give Os - car the flick With no

2: Ch_Sl accom A cryp - to - sys - tem that will give Os - car the flick

3: Ch_A String A cryp - to - sys - tem that will give Os - car the flick

22

1: Bob fear Al - ice can send to me What - e - ver she wants, with my pub - lic

2: Ch_Sl accom

3: Ch_A String

28

1: key _____
Bob

2: Ch_Sl
accon
What - e - ver she wants with his pub - lic key

3: Ch_A
String
What - e - ver she wants with his pub - lic key

35

1: _____
Bob
This new

2: Ch_Sl
accon

3: Ch_A
String

42

1: cryp - to sys - tem de - fies a - na - ly - sis Might I say, I'm such a ge - ni - us
Bob

2: Ch_Sl
accon

3: Ch_A
String

49

1: _____
Bob
I mean Doc - tor Clarke's such a ge - ni -

2: Ch_Sl
accon

3: Ch_A
String

56

1: us Pub - lic key cryp -

Bob

2: He mean Doc - tor Clarke's such a ge - ni - us

Ch_Sl
accon

3: He mean Doc - tor Clarke's such a ge - ni - us

Ch_A
String

63

1: to - lo - gy! I've sa - bot-aged Os - car's plans with my pub - lic key

Bob

2: He's

Ch_Sl
accon

3: He's

Ch_A
String

69

1: —

Bob

2: sa - bot-aged Os - car's plans with his pub - lic key

Ch_Sl
accon

3: sa - bot-aged Os - car's plans with his pub - lic key

Ch_A
String

76

1: Os - car knows that

Bob

2: —

Ch_Sl
accon

3: —

Ch_A
String

83

1: Bob he has lost the fight Just as long as my pri - vate key's out of sight

2: Ch_Sl
aconn Just as

3: Ch_A
String Just as

90

1: Bob Os - car does - n't have a chance

2: Ch_Sl
aconn long as his pri - vate key's out of sight *Oscar: I don't agree*

3: Ch_A
String long as his pri - vate key's out of sight

96

1: Bob Well, what are you going to do a - bout my pub - lic key?

2: Ch_Sl
aconn Yes, what are you going to

3: Ch_A
String Yes, what are you going to

102

1: Bob

2: Ch_Sl
aconn do ab - out his pub - - - lic key?

3: Ch_A
String do ab - out his pub - - - lic key?

No.9 - Quartet (The All-nighter)

from Keep on Coding

Eric Love

1

1: 8 Alex & Rod

We've worked here all day and we'll stay here all night Keep co - ding 'till two and then

2: Pete

We've worked here all day and we'll stay here all night Keep co - ding 'till two and then

3: Nick

We've worked here all day and we'll stay here all night Keep co - ding 'till two and then

5

1: 8 Alex & Rod

sleep (well we might) We're trash - ing our bo - dies and mash - ing our brains In crash - ing this task so we

2: Pete

sleep We're trash - ing our bo - dies and mash - ing our brains In crash - ing this task so we

3: Nick

sleep We're trash - ing our bo - dies and mash - ing our brains In crash - ing this task so we

9

1: 8 Alex & Rod

don't crash our trains We've _____ worked here all day and we'll soon sleep to - night But

2: Pete

don't crash our trains We've worked here all day and we'll soon sleep to - night But

3: Nick

don't crash our trains We've worked here all day and we'll soon sleep to - night But

The musical score is written for three voices: Alex & Rod (treble clef), Pete (bass clef), and Nick (bass clef). The time signature is 6/8. The key signature has two flats (B-flat and E-flat). The score is divided into four systems, each starting with a measure number (1, 5, 9). The lyrics are written below the notes, with some words hyphenated across lines. The first system (measures 1-4) has the lyrics: 'We've worked here all day and we'll stay here all night Keep co - ding 'till two and then'. The second system (measures 5-8) has the lyrics: 'sleep (well we might) We're trash - ing our bo - dies and mash - ing our brains In crash - ing this task so we'. The third system (measures 9-12) has the lyrics: 'don't crash our trains We've _____ worked here all day and we'll soon sleep to - night But'. The fourth system (measures 13-16) has the lyrics: 'don't crash our trains We've worked here all day and we'll soon sleep to - night But'. The lyrics are repeated for each voice part in each system.

13

1: Alex & Rod in the CATS suite you can't turn off the light But sleep-ing is not such a hard thing to do when you've

2: Pete in the CATS suite you can't turn off the light But sleep-ing is not such a hard thing to do when you've

3: Nick in the CATS suite you can't turn off the light But sleep-ing is not such a hard thing to do when you've

17

1: Alex & Rod worked half the night and the clock says it's two We've_____ worked here all day and we'll

2: Pete worked half the night and the clock says it's two We've worked here all day and we'll

3: Nick worked half the night and the clock says it's two We've worked here all day and we'll

21

1: Alex & Rod stay here all night Some o - ther groups have been e - qual - ly bright Leav-ing the work 'till the

2: Pete stay here all night Some o - ther groups have been bright In Leav-ing the work 'till the

3: Nick stay here all night Some o - ther groups have been bright In leav-ing the work 'till the

25

1: Alex & Rod dead - line was near Now do - ing an all - night - er with us in here No!_____ *Greg's verse goes here*

2: Pete dead - line was near Now do - ing an all - night - er with us in here No!_____

3: Nick dead - line was near Now do - ing an all - night - er with us in here No!_____

30

1: Alex & Rod
 We've worked here all day and we'll work through the night This last piece of news now has

2: Pete
 We've worked here all day and we'll work through the night This last piece of news now has

3: Nick
 We've worked here all day and we'll work through the night This last piece of news now has

34

1: Alex & Rod
 come as a fright Our life-style this week has been mak-ing us tired But a few more all night-ers we think are re -

2: Pete
 come Our life-style this week has been mak-ing us tired But a few more all night-ers we think are re -

3: Nick
 come Our life-style this week has been mak-ing us tired But a few more all night-ers we think are re -

39

1: Alex & Rod
 quired

2: Pete
 quired

3: Nick
 quired

No.10 - Alice's song (It's me)

from Keep on Coding

orig. Sixpence None the Richer, KoC by Eric Love

1

1: Alice v1

It's me

2: Alice v2

It's me

6

1: Alice v1

This sig - na - ture is mine Use my key

2: Alice v2

No - one can sign this way But me

8

1: Alice v1

De - crypt it, check the time You should see

2: Alice v2

So I can fi - nal - ly say safe - ly

10

1: Alice v1

that it's not out of date Ig - nore this mes - sage if it's at all late Oh,

2: Alice v2

what - e - ver I like You can tell Os - car to get on his bike Oh,

13

1: Alice v1 It's _____ me _____ Os - car could not _____ have sent this

2: Alice v2 It's _____ me _____ Os - car could not _____ have sent this

15

1: Alice v1 Be - lieve _____ me _____ A gen - u - ine _____ it is _____

2: Alice v2 Be - lieve _____ me _____ A gen - u - ine _____ it is _____

17

1: Alice v1 _____ Read this mes-sage through _____ A for - ge - ry _____ would be as

2: Alice v2 _____ Read this mes-sage through _____ A for - ge - ry _____ would be as

19

1: Alice v1 hard as find - ing out your pri - vate key 'Cos it's me

2: Alice v2 hard as find - ing out your pri - vate key 'Cos it's me

No.11 - Quartet & Chorus

from Keep on Coding

Original (from CATS) by TS Elliot & AL Webber, KoC by Eric Love,

1

9: P1

Alex & Pete 8vb

10: P2

There's a whis - per down the line at e - lev - en thir - ty nine The Bel -
Rod

11: P3

There's a whis - per down the line at e - lev - en thir - ty
Nick

4

9: P1

10: P2

air train's read - y to de - part — But we've lost the disk with the in - i - tial - is - ing file The Be -
Rod & Pete

11: P3

nine The Bel - air train's read - y to de - part

8

9: P1

Alex & Pete 8vb

10: P2

lair train just can't start All our friends who are in sight (and if we're
Rod

11: P3

All our friends who are in

11
9: P1

10: P2
des - p'rate, Da - vid Knight) Will be search - ing high and low Say - ing
Rod & Pete

11: P3
sight (and if we're des - p'rate, Da - vid Knight) Will be search - ing high and low

14
9: P1

10: P2
"we can't go a mile with - out the start - up file" The Be - lair train just can't go At e -

11: P3

18
9: P1

10: P2
lev - en for - ty two with the sig - nal o - ver - due And we en - gi - neers all fran - tic to a man It was
Rod

11: P3

22

9: P1

Alex & Pete 8vb

10: P2

in my oth - er pock-et so there was-n't a - ny need to go And type it in the code by hand And—

11: P3

27

9: P1

10: P2

then we got it load - ing sav - ing us a lot of cod - ing And the sig - nal went "All—
(with Pete)

11: P3

And then we got it load - ing sav - ing us a lot of cod - ing And the—
(with Pete)

30

9: P1

10: P2

clear" — And we're off at last, soon to qual - i - fy As a

11: P3

sig - nal went "All clear" And we're off at last, soon to qua - li -

45

9: P1

10: P2

E B C#m

11: P3

press From the en - gine dri - ver func - tion to the swit - ches at each junc - tion It would

Rod

48

9: P1

10: P2

G#m A E E B

11: P3

su - per - vise them all, more or less It as - serts each switch is set and re -

Pete

51

9: P1

10: P2

C#m E A D A E

11: P3

qui - re - ments are met by re - serv - ing sec - tions of track It es -

Nick

54

9: P1

10: P2

B C#m G#m A

11: P3

tab - lished con - trol by a re - gu - lar pat - rol And would know at once if Fred has changed one

57

9: P1

They — safe - ly passed though Good - wood and then Mit - cham and then Black-wood The i -

chorus SM/MA with Rod &vb above

10: P2

E We — safe - ly passed though Good - wood and then Mit - cham and then Black-wood The i -

Alex & Pete

11: P3

back They/We safe - ly passed though Good - wood and then Mit - cham and then Black-wood The i -

chorus B / Nick

60

9: P1

ma - gin - a - ry pas - sen - gers in - side En - joyed the ex - press ser - vice, there was no need to be ner - vous On the

chorus SM/MA

10: P2

ma - gin - a - ry pas - sen - gers in - side

chorus B

11: P3

ma - gin - a - ry pas - sen - gers in - side

all 4 engineers

64

9: P1 sim - u - la - ted half hour ride _____ Trains will stop at ev' - ry sta - tion in the

10: P2 _____ Trains will stop at ev' - ry sta - tion in the

11: P3 _____ Trains will stop at ev' - ry sta - tion in the
A & R / Pete / Nick

68

9: P1 fi - nal de - mon - stra - tion when _____ Fred and Mi - chael see them a - gain _____

10: P2 fi - nal de - mon - stra - tion when Fred and Mi - chael see them a - gain *Greg*

11: P3 fi - nal de - mon - stra - tion when Fred and Mi - chael see us a - gain _____ There will *unison*

71

9: P1

10: P2 B C#m G#m A

11: P3 be no sus - sponse when we come back one month hence With the pro - gram of the rail - way

74

9: P1 With thir - teen qua - vers in ev' - ry bar, cour-te - sy of An - drew Lloyd Web - ber, we now con - clude
chorus SMA

10: P2 E/With thir - teen qua - vers in ev' - ry bar, cour-te - sy of An - drew Lloyd Web - ber, we now con - clude
chorus B

11: P3 train

77

9: P1 sing - ing of the pro - gram of the rail - - way train _____

10: P2 sing - ing of the pro - gram of the rail - - way train _____

11: P3

81

9: P1 an wer off at last, soon to qual - i - fy As a soft-ware en - gi - neer
Alex & Rod 8vb

10: P2 off at last, soon to qual - i - fy As a soft-ware en - gi - neer
Pete & Nick

11: P3

No.12 - Noise song

from Keep on Coding

Eric Love

1

1: Alice

1: Alice

2: Bob

2: Bob

3: Chorus
SMA,
...

3: Chorus
SMA,
...

4: Chorus
B,
...

4: Chorus
B,
...

7

1: Alice

1: Alice

Os - car is gone, no more prob - lems with se - cu - ri - ty

2: Bob

2: Bob

But

3: Chorus
SMA,
String

3: Chorus
SMA,
String

Noise, noise, noise, noise,

4: Chorus
B,
...

4: Chorus
B,
...

13

1: Alice
 There's a way to send a mes - sage, it will

2: Bob
 with this noi - sy me - di - um now, our prob - lem is cla - i - ty There's a way to send a mes - sage, it will

3: Chori
 SMA, noise, noise, noise, noise, noise, noise,
 String

4: Chori
B, . .

19

1: Alice
 work, we gua - ran - tee

2: Bob
 work, we gua - ran - tee

3: Chori
 SMA, noise Say it thrice! Say it thrice! Say it thrice!
 String

4: Chori
B, . .

25

1: Alice
 Tell me, can you hear me Bob? Is tri - ple re - pe - ti - tion real - ly do - ing its job? The

2: Bob

3: Chorus
 SMA, Strings
 Noise, noise, noise, noise, noise as loud can be

4: Chorus
B, . .

31

1: Alice code's no good if twice from three The noise is such that you mis-hear me Tell me, can you hear me Bob? Is

2: Bob

3: Chorn SMA, String Noise, noise, noise, noise, in the key of C Noise, noise, more noise,

4: Chorn B, ...

37

1: Alice tri - ple re - pe - ti - tion real - ly do - ing its job? The code's no good if twice from three The noise is such that you mis-hear me

2: Bob

3: Chorn SMA, String with va - ri - e - ty Noise, noise, noise, noise, noise in har - mo - ny

4: Chorn B, ...

43

1: Alice Tell me, can you hear me Bob? Is tri - ple re - pe - ti - tion real - ly do - ing its job? The code's no good if twice from three The

2: Bob

3: Chorn SMA, String Noise, noise, more noise, drown out ev - ry word Noise, noise, noise, noise,

4: Chorn B, ...

63

1: Alice code which saved the day We com-

2: Bob De - spite the noise I was ab - le to hear all that Al - ice had to say We com-

3: Chorn SMA, String noise, noise, noise, noise, noise, noise

4: Chorn B, . . .

69

1: Alice mu - ni - ca - ted though the me - di - um was ma - li - cious Say it thrice! Say it thrice! Say it

2: Bob mu - ni - ca - ted though the me - di - um was ma - li - cious Say it thrice! Say it thrice! Say it

3: Chorn SMA, String noise, Hey! Say it thrice! Say it thrice! Say it

4: Chorn B, . . .

75

1: Alice thrice!

2: Bob thrice!

3: Chorn SMA, String thrice!

4: Chorn B, . . .

No. 13 - Rod's song (Runaway Train)

from Keep on Coding by Eric Love, this song's original by Soul Asylum

1 C Em

The train was lost, it had missed its des - tin - a - tion And kept go - ing to -

4 Am G

wards the next sta - tion An emp - ty train was wait - ing there___ but the run - a - way train did - n't

8 C Em

seem to care___ Run - a - way train ne - ver com - ing back___ Wrong way on a

12 Am G

one way track___ On the track it was go - ing some - where But on thwe train nei - ther

16 F G C Am

here nor there The Em - er - gen - cy___ Stop we re - ques - ted did - n't take ef - fect___ Al - though we'd tes - ted

21 F Em G C

it, in fact we'd tes - ted ev' - ry - thing The train wrecked, two hund - red

26 Em Am

peo - ple dead___ I did - n't get much sym - pa - thy from Fred___ If I could do it all a - gain___ I'd

31 G C

do all I could___ to stop a run - a - way train___

No.14 - Finale

from Keep on Coding

Eric Love

1

12: *p* *solo S* When Term Four's done A u-ni-stu-dent Post-pones fun If he is pru-dent Gets his notes and

13: *p* *piano*

14: *P*

7

12: *p* has a read Be-com-ing a stu-dent in-deed! He goes through quite a chaste time Dur-ing which he will not waste time It's a

13: *P*

14: *P* *brass*

12

12: *P* stu-dy-stu-dy haste time! And e-ven Prac-ti-ca-li-ties of his course Which are in-ter-est-ing

13: *P*

14: *P*

16

12: *p* Aren't worth an-y dis-course If they're not for test-ing In No-ven-ber in re-al-i-ty For

13: *P* *strings*

14: *P*

20
 12: P such a prac-ti-cal-i-ty To in-ter-est one much is rare for cer-tain But a-gainst the gen'-ral law Are two cas-es that we saw And

13: P

14: P

25
 12: P we'll re-vis-it 'ere we draw the cur-tain

strings

13: P

In
 Alice

14: P

31
 12: P

13: P cod-ing and cryp-tol-o-gy we took a large an-thol-o-gy Of notes a-bout se-cu-ri-ty and mes-sage sig-nal pu-ri-ty Just in

14: P

36
 12: P

13: P case you had-n't seen Bob and I were ver-y keen To get a sys-tem work-ing where in spite of Os-car lur-king We'd have safe com-mu-ni-

14: P

41
 12: P We saw them get a sys - tem work - ing
solo S

13: P ca - tion from un - au - thor - ised trans - la - tion

14: P *brass* *piano*

47
 12: P Where in spite of Os - car lur - king They had safe com - mu - ni - ca - tion
chorus SM *strings*

13: P Where in spite of Os - car lur - king They had safe com - mu - ni - ca - tion
chorus A *piano*

14: P They had safe com - mu - ni - ca - tion *chorus B* Though *Bob*

54
 12: P

13: P Oscar May I re - mind you that at first I cracked your ci - phers good and

14: P Os - car tried his worst, By the end he could - n't stop her

58
 12: P

13: P pro - per!

14: P That the ciph - ers of mine and A - lic - e's Did - n't stand up to Os - car's crypt - a - na - ly - sis Mat - ters

63
12: P

piano

13: P

14: P lit - tle to our fi - nal grade, I am A - ware that Quinn and

68

12: P

13: P

14: P Clarke Told us that our fi - nal mark Would come eight - y - five per - cent from the ex -

73

strings

12: P

13: P

There - fore may I men - tion that be - cause we paid at - ten - tion When -
Alice

14: P am

77

12: P

13: P

ev - er Clarke or Quinn spoke to the class And we stud - ied this stuff more than all the o - ther ones I'm sure

14: P

And we stud - ied this stuff more than all the o - ther ones I'm sure

81

12: P To sing in such a field as pure maths seems a - vant - garde One

solo M

13: P So I think this sub - ject we will pass

strings

14: P So I think this sub - ject we will pass

86

12: P has a heav - y pen to wield, the rhym - ing's ver - y hard The po - et has to play tricks and ma - nip - u - late the main text To make

13: P

14: P

90

12: P rhymes for words like ma - trix, ci - pher, eaves - drop - ping and plain - text!

13: P

14: P I was looking for a word to rhyme with Cou-ri-er, *Courier*

94

12: P In less than sc - ien - ti - fic fields it's *solo M*

13: P

14: P at length I tried, The one I got won't do this time; That ma - the - ma - tics is ap - plied!

100

12: P eas - i - er for you You find the gen' - ral lan - guage yields a syn - o - nym or two But it's not the hard - est thing to ask to

13: P

14: P

104

12: P put some maths to verse In chem - is - try I'm sure the task would be a great deal worse

F
Greg

13: P

All se - mes - ter,
Svb Rod

14: P

109

12: P Bb C F F Dm

13: P I be - lieve, My life was all a - bout the pro - ject. Now I'm try - ing to con - ceive What

14: P

114

12: P Gm C F Bb Bbm C

13: P life was like with - out the pro - ject. I worked so hard, at the ex - pence Of all my o - ther stu - dies. Yes,

14: P

120

12: P C F D⁷ F C F F B^b

13: P this se - mes - ter was in - tense for me and these, my bud - dies. We could have been much smart - er
8vb Alex & Rod

14: P We could have been much smart - er
Pete & Nick

126

12: P C F F D^m G^m C

13: P And planned our test - ing ses - sions And a - na - lysed the test log da - ta In - stead of rest - ing ses - sions. In

14: P And planned our test - ing ses - sions And a - na - lysed the test log da - ta In - stead of rest - ing ses - sions. In

132

12: P F B^b B^{bm} C C F D⁷

13: P ref - rence to our fi - nal grade It won't mat - ter how our pro - ject went In the me - thod our marks are made, The ex -

14: P ref - rence to our fi - nal grade It won't mat - ter how our pro - ject went In the me - thod our marks are made, The ex -

138

12: P F C F They will keep on cod - ing E - ven af - ter ye - ar's close While
chorus S

13: P am's worth se - ven - ty per - cent. They will keep on cod - ing E - ven af - ter ye - ar's close While
chorus MA

14: P am's worth se - ven - ty per - cent. They will keep on cod - ing E - ven af - ter ye - ar's close While
brass chorus B

145

12: P know - ledge is e - rod - ing Of these things in heads of those Who ne - ver real - ly need - ed it And on - ly real - ly

13: P know - ledge is e - rod - ing Of these things in heads of those Who ne - ver real - ly need - ed it And on - ly real - ly

14: P know - ledge is e - rod - ing Of these things in heads of those Who ne - ver real - ly need - ed it And on - ly real - ly

152

12: P heed - ed it to pass ex - ams, as ev - 'ry bo - dy knows. _____ F Bb Gm
chorus S / Greg

13: P heed - ed it to pass ex - ams, as ev - 'ry bo - dy knows. _____ Ev' - ry thing we cram In - to our heads in No -
chorus M / chorus A & Alice

14: P heed - ed it to pass ex - ams, as ev - 'ry bo - dy knows. _____ Ev' - ry thing we cram In - to our heads in No -
Alex, Rod, chorus B / Pete, Nick, Bob

160

12: P Csus C F Bb Csus C F

13: P vem - ber Is there for the ex - am But is gone by De - cem - ber But what you've seen us stu - dy here Is
S / M / A & Alice

14: P vem - ber Is there for the ex - am But is gone by De - cem - ber But what you've seen us stu - dy here Is

167

12: P _____ C F Bb Csus7 C F
Greg

13: P learnt by heart so ne - ver fear, We will re - mem - ber, We will re - mem - ber

14: P learnt by heart so ne - ver fear, We will re - mem - ber, We will re - mem - ber