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The Story of COMAL told by Borge Christensen

Are you going to be moving around a lot during your talk, or will you be fairly stationary?

What would you prefer?

Well, I don't mind.

I promise you that I will no do Danish Folk Dancing.

Oh.

That would be a disaster. We would probably be thrown out of NATO afterwards.

Anytime you are ready.

I'm ready now. Well, I'm going to simply talk. Well, I'd like to thank you all for coming. First, excuse me if sometimes it happens that I misspeak the words. It is a foreign language to me and my stock of words could all of a sudden disappear. You'll hear me searching for a word. Please bear with my language.

I have been so surprised to see the enthusiasm in America about this language of ours. What I'm going to talk about tonight might help you understand why I am surprised because this was from the start a very humble project, in a very small town, in a very small country, where it usually is quite cold, which might be one of the reasons why we are sitting so much indoors at our computers of course.

From the start this was a very humble project, in a very small town, in a very small country, where it usually is quite cold.

It started, in fact, in ... well, I might add one or two words about myself. I am hired by her Majesty, the Queen of Denmark, to teach Mathematics at a small college near the German border. When I say that I am hired by her Majesty, the Queen, it is actually true. I have a contract with her signature on it. Now you know how small our country really is. Her majesty does not go out each night and lock the door to the kingdom, as it says in Hans Andersons fairy tales. But, she can sign contracts, personally, with some professors, at some colleges, in some positions. So, she expects me to teach Mathematics, and that's what I'm doing.

Besides that I have to give courses in Computer Studies, specifically with applications of a mathematical kind. And that was how it all came about. In 1972 we got a Data General NOVA 1200 mini-computer, which some of you might know or have heard rumors about. We were supposed to start this new subject, Computer Science. Since I had long time ago taken a course at the University (only three weeks, but they didn't know that), I was expected to take care of this new thing, and try to teach the students how to use it.

The language that came with it was called Extended BASIC. One of the first things that we experienced was that it was so crowded with bugs that even the cleaning person began to complain about it. It was real bad. It broke down ... it was a so called core share system - no disk. It was only paper tape, all of it. Paper tape and teletypes. And it broke down regularly every four hours, so we had to re-install the programs by reading the paper tapes at a speed of 10 characters per seconds. It was quite a job. I think even this one would seem fast compared to that [referring to a Commodore Disk Drive]. This is, as you know, the worlds fastest tape station.

Another thing that seemed to go wrong was the way the students performed. That was to put it mildly ... miserably. The programs, even small programs were very bad. They didn't understand much of it, and it happened again and again that they could do it much easier on their pocket calculators.

Also, for myself, I found it extremely difficult to mark their works, because it was hard to read, simply to read their programs. Twenty or thirty line programs were hard to find out what was going on. I had to draw diagrams very often, simply to find out what they had did, what methods they had applied, what approach they had used. Of course, it might have been me that was not good enough, but that is an uncomfortable idea, that you're not good enough, so after awhile, I went to a nearby university, I knew their Computer Science section was a very good one ... in fact I went there because we had to set up some exam papers, some examination problems, and I didn't know what to do about this, because I could see disaster ahead, even if I only gave them simple problems to solve in this language, this so-called language, BASIC.

Here, in the afternoon, I met a man, his name was Benedict Lofstedt. When I came in and explained to him what this was all about, he said: *Well, this is not your fault, this is not the students fault, it is the language that you are using. It is in fact, not a computer language. It is an offense to the human mind.*

I am a mathematician, I'm not a computer scientist. And we were quite impressed by this new technology. It cost a whole lot of money and the local newspapers had written about it. So, I was surprised that he asked me to go back and read a new book by Niklaus Wirth called Systematic Programming. In that book he presented a language called Pascal. So we looked at it and I could see at once that this was what programming ought to be about.

Now, we couldn't use that Pascal directly. As it was, it was a very good language for advanced University students and professionals. But for my students, it would be impossible.

It is important to understand that there is a difference between the language itself, and the operating environment this language is working in.

There are one very good thing about BASIC ... it's interactive. You can type in small programs, have them run at once. You won't have to write a program using an editor, having the text stored, have the compiler load it, compile it ... going through all these phases of editing, compiling, and manipulating the operating system; that would be far too complicated for the students I had. So, we would have to maintain some of the user friendly environment there is in BASIC. I think that is the only good thing you can say about BASIC, it's the user environment. And it is important to understand that there is a difference between the language itself, and the operating environment this language is working in. We found out that when we tried to define the language.

Benedict Lofstedt, the computer scientist, and myself wrote letters to each other over a period of half a year, and tried to define another sort of language. We took what we had of BASIC, and added the structures of Pascal. So it is true, that we took the best from BASIC and the best from Pascal.

It would be very hard, I knew, to have it implemented. One thing is to define a programming language. We had finished the definition in fact by the beginning of 1974 - we had the first definition, of what later became COMAL 75. But to implement it is quite a different story. We went to one of the major companies and they asked me, rather cynically by the way, unfriendly, to come back again with $50,000; then they might consider the whole project. Otherwise we could go ahead with what we had. No understanding at all.

We went to one of the major companies and they asked me, rather cynically by the way, unfriendly, to come back again with $50,000.

Well, I then had what you would call a really good fortune. I got two very bright students. I did machine coding at the NOVA, which was in fact a 16 bit machine, and I told them how to code, machine code. In a few weeks they became much better at that than I was, than I ever became. They were young people, and had learned it very fast.

One day one of them came up, and said: *This definition of yours that Benedict and you have been doing. I think we can do that.*

I was very happy and surprised. Well try it.

They worked on it for about half a year, and eventually came up with the first implementation. We had a very close co-operation. Again and again we took discussions on how to implement the different details. I can still remember the day that we tried to put in long variable names. This was a problem then. There were no long variable names. Instead of saying number, name, we could only say N or N1. Still I think there are many BASICs that only allow short variable names.

We had a huge board where we wrote down all sorts of ideas. It was a great experience. It was quite fantastic, to be in that process with these two extremely clever young boys.

But we wanted them, wanted them right away in the first version to be at least 8 characters. We wanted to allow 8 characters. At least we would then be able to give variables sensible names. Such that the programs would be much more readable. This one of the first things we were after.

We found out somehow, that by putting these names in arrays, and using tokens to address them,

and thereby addressing their data fields, that we could do it that way. This sort of discussions were going on for half a year. We had a huge board where we wrote down all sorts of ideas. It was a great experience. It was quite fantastic, to be in that process with these two extremely clever young boys.

We poured coffee in him, and put him into a cold shower. Then he would work for 24 hours. It was just great.

I had a problem with one of them. He was a heavy drinker. Now and then he would go away, and we knew where he was. But only at a certain time when he had had enough could we pick him up. We could not persuade him to come back again until he had taken so and so much. He would then be very drunk. And we needed him, as he was our expert in debugging. Danish beer can be quite heavy, quite strong. We poured coffee in him, and put him into a cold shower. Then he would work for 24 hours. It was just great.

The first version of COMAL ... still we hadn't called it that, we had a Danish name for the project ... was running on the 5th of August, 1974. It was a five line program with a REPEAT ... UNTIL. And we had all the automatic indentation ... that was all done. We were working on the IF .. THEN .. ELSE with indentation. We pinned it on the board, and it was stolen a fortnight later, so I don't know where it is. This is quite a pity.

We had no disk! No diskette, no hard disk, no soft disk, or anything. We sent it out on paper tapes.

In February 1975, we had a version to send out. Now, you should imagine that we would send it out on a disk. We had no disk! No diskette, no hard disk, no soft disk, or anything. We sent it out on paper tapes this size.

I don't know if any of you have worked on a teletype.

Several people cried out Yes!

OK ... you know what it's like. Most would have a high speed reader, typically, 500 characters per second, which was quite respectable. But many of them would have to use a teletype 10 characters per second... it took one hour to load COMAL. So please don't complain over this. (God bless the poor fellow who then switched the whole thing off by some mistake).

Again and again we went around ... by the way, when we implemented, we only had paper tape. We had a fast paper tape punch and a fast paper tape reader, but we used miles on end of paper tape. Sometimes were walking around in paper tapes up to our knees. My job most of the time was to wind up ... I invented a very fine technique. I think I could even do it today if I had a chance ... wind it up very fast.

This was an experience of a lifetime, to be doing such a thing. It was absolutely fantastic.

One thing that might happen eventually, you probably know that ... I need to tell you that the whole implementation cost me $300. That was all we had, so we did it in our spare time ... we thought it was great fun. And it was. This was an experience of a lifetime, to be doing such a thing. It was absolutely fantastic.

When we were in the process of reading in a paper tape, it happened eventually that one stepped on it. And we could start all over again, because the paper tape broke. This was one of the deadly sins, I don't know how many are allowed.

We were fortunate, because most of the institutions that were of our type, (high schools, colleges, vocations schools, etc) had in fact Data General NOVAs, because one local Danish company was the distributor of that machine. We didn't have problems with such obscure machines such as Hewlett Packard or whatever that is. We had the NOVA all over. So they took it and started to use it. We were quite successful. I think it took half a year and they had stopped using the regular BASIC and turned over to COMAL.

Now, as it appeared, the major reason for doing that was the long variable names, believe it or not. Especially the students. The teachers were more hesitating, but the students took it very fast. They could now write NUMBER=5 or NAME$="Peter Sorenson".

And then the IF .. THEN .. ELSE. That was one that really was bought at once. I don't know if you are aware that doing branching, especially nested branching, using GOTO is in fact very very difficult. Therefore we had the nested IF ... ELSE ... ENDIF only up to a level of four at that time, but that appeared to be enough.

And then of course, the third facility, was the named procedures. We didn't have parameters at that time. You might call it simply named subroutines. Instead of saying GOSUB 5000, we could say EXECUTE PRINTOUT. And then you would have PROC PRINTOUT ... ENDPROC. That was all there at that time.

The first COMAL included:
- **Long Variable Names**
- **IF .. THEN .. ELSE**
- **Procedures & EXECUTE**

This was all much much easier. And it was faster. This was another thing we noted and which helped us. I don't know if you are aware that when BASIC tries to find line number 5000 starting at line number 10, it will go over all the line number to try to find it. In the first COMAL we did, we put up links, such that if there was an EXECUTE (that was the keyword we used) EXECUTE PRINTOUT in say line 50, and PROC PRINTOUT would appear in line 500, there was a pointer telling line 50 to jump at once (in machine code) to line 500. That of course was much much faster than having to go sequentially through all the line numbers. It was also one of the advantages that made COMAL popular very fast.

We were well aware that we should have some fancy English looking name, otherwise no one would have it.

This went on, and I gave it the name ... in fact, I can tell you how that happened ... the name COMAL. We had been discussing for a week what we should call it. We couldn't use the Danish name, we were well aware that we should have some fancy English looking name, otherwise no one would have it. In fact, I was on my bicycle from the college back home when it appeared to me, that we had been fooling around with the language ALGOL, which you probably know, ALGOrithmic Language, and all of a sudden it appeared that this should be COMMON Algorithmic Language. Shortened is COMAL. That was in fact how the name was made. That's all. It is a really country name.

That was, in fact, how the name was made. That's all. It is a really country name.

We continued to improve it a little ... as I said before, we then sent it out. I was not doing much more machine coding, because the students asked me to write the documentation. That's of course a very important thing. I also wrote a text book which later became Beginning COMAL. That took 3 or 4 years before it developed into the Danish edition of that book.

This went on until around 1978, when the first microcomputers appeared. We got a problem. The problem we had to face would be the following. Imagine the Danish schools had started to buy PET or APPLE. That meant that we were sent back to BASIC again. This was to me very frightening. It was so frightening in fact that if I had been forced to teach BASIC again, I would not have taught computers at all. That's true! I was completely determined, if they were to force me to teach BASIC again I would have said: **OK, you hired me to teach Mathematics, Algebra, Statistics, and Number Theory, and I'm good at that, so that's what I'm going to do. You can take your computers somewhere else.** I was absolutely determined to do that. But of course, it would be better if we could come up with a microcomputer with COMAL.

So in 1978 I defined a new version, where we put in the parameter mechanisms and the sort of things you know now, most of it at least. And we found another group in a college somewhere else that were willing to try to improve, enhance, expand COMAL into what we call COMAL 80 because it was not until 1980 when it was really finished, and it was running on a Z80 based computer, Zilog 80. So we had two reasons to call COMAL 80.

At the same time another Danish company designed and built a computer for schools. It was called the Comet. We are not always that modest in Denmark. It appeared to be a very good computer by the way. It is still used especially at technical schools

because it has one of those busses where you can add in extra electronics all the time to the buss. It is still very popular. That was the first computer to run a COMAL that you would recognize. If you saw programs written for that computer, you wouldn't be surprised at all. This would look very much like what you see today. What had to come would then be to make better environment, better editors, to put in extra facilities, such as graphics, sprites, and sound.

This was simply one of the most qualified critics that I ever had. It was very good.

But at that time, 1980-1981, I stopped doing much about it. It was then taken over by different groups, one of which is UniComal which is one of the most talented. Maybe I should add now about the way UniComal started. One of them Mogens Kjaer, wrote a letter to me, where he criticized my definition of COMAL 80. When I saw this letter, I knew that once that he would be one of the boys that could do something about it. This was simply one of the most qualified critics that I ever had. It was very good. I adjusted my COMAL according to what he advised me to do. And then I asked him if he might do ... he had intended to do an implementation for a computer that wouldn't have any chance of going anywhere. I advised him not to do that, but instead to go for the Commodore PET. It was obviously a very good computer.

A company could not sell a computer to a Danish school if it did not have COMAL.

At that time, you should know, by the way, a company could not sell a computer to a Danish school if it did not have COMAL. Hewlett Packard never sold their computer since it did not have COMAL. We had given it such a strong position. The teachers wouldn't have it. The teachers refused to use BASIC. That was a very strong situation. We hold in fact a very strong position without telling anybody. Simply by giving them a language that was apparently better.

Mogens Kjaer made this version for Commodore, and this is the version now known as 0.14. After he did that, the UniComal group was set up and they then went on. From then on I have not had much to do with it. These young fellows are doing a terrific good job. They added the packages, which is probably the most important extension to COMAL that was made after the latest definition. This was the package concept that you could have packages in machine code and call them.

From then on you know more or less what the story is all about. Still a new version now is being designed for the Z80 CP/M based computers for there is an English computer called the Amstrad, which is quite popular in Europe. They expect to sell around 600,000 of them. We have a version of COMAL for that now [this is the CP/M COMAL]. It is very much like the UniComal version. There are a few improvements, but not much.

What I'm interested in now ... I don't think we should expand COMAL much more. I feel perfectly well with the version for the Commodore 64. I have 17 of them for my students. We will probably have one or two PC's only because an institution like ours must have PC's. I probably can persuade someone to use them if we get them.

What I'm interested in now is to see a better user environment.

What I'm interested in now is to see a better user environment. It has improved very much with FIND and CHANGE. I would like to see full screen editors, without line numbers. There is a COMAL, Mytech [Alder] COMAL, with such a very good editor, but I'm sorry to say that the COMAL is not as good as it ought to be, but that may come. There is now an international standardization committee. We have a meeting in Scotland in September. We are going to discuss, among other things, whether we should get rid of line numbers, or at least make them redundant. You can get them if you like, but you can avoid them. You are aware I expect, that line numbers are not needed after we have left the teletype. You can with a screen editor, you can move the cursor wherever you like, and insert a line by manipulating some control code. Whereas with the teletype, line numbers were quite ingenious. You couldn't get back to the place between line 10 and 20, but you could print line 15 and have it inserted between line 10 and 20. This was in fact very well made considering that it was made for teletypes. But they are, I think, gone long ago.

If anyone had told me in 1974 that ten years later I would be standing in Los Angeles, I probably wouldn't have believed him.

This is more or less how it was. When we started it, we ... well if anyone had told me in 1974 that 10 years later I would be standing in Los Angeles, I probably wouldn't have believed him. Because we only wanted, as simple as that, was a tool that our students could use. Nothing pretentious or great project or anything. It appeared that our students could use it, it has developed over the years. It is therefore, as you may guess, very impressive, and makes me ... Well I don't know exactly how happy I really am, maybe I'll find out when I come back, maybe, that you really like it and are so enthusiastic about it. I think it is a good tool. It appears to be so. And I hope that many more people can get to know about it.

Well, you are welcome to ask questions and ... that's a lot of detail, but I may add that I used a slogan ... I hope you don't think I'm nasty ... I used a slogan that in the 70's I said that: **It might very well be that the good God has invented the computer. But there is no doubt that his black majesty then came up with BASIC shortly thereafter [laughter] ... in order to confuse peoples minds, because that's the way he prefers to operate. [applause].**

I would like to begin by taking a poll. Of all the COMAL programmer here, I would like to hear yays or nos from those who would like to see line numbers implemented for COMAL 2.0. All who would like to have line numbers ...

[interruption] What about how it is to be implemented? If you remove line numbers, how do you differentiate being in command mode and being in program mode.

That's right. Now, I think I said that it should be made redundant. But you would have to have two modes, an editing mode, and a runtime mode. In fact you can see it on the Mytech [Alder] COMAL, how it operates. There's no problems. I can demonstrate it after this meeting for whoever likes to see it. This is very easy to implement and use. But still you can use line numbers.

What would be the object of getting rid of the line numbers? What is the point? What is the big controversy of getting rid of them?

I would hate to admit that it is some academic idea. But I think it is. The idea is ... when I say full screen editor, I do not mean only the text you can see on the screen right now, but you should be able to scroll up and down. You can now in COMAL have the listing coming up, but you cannot take the cursor up and have the listing coming down again [note: this is now possible in IBM PC COMAL, AmigaCOMAL, and C128 cartridge COMAL]. So you should be able to look at the screen as simply a window, through which you pull a film either forward or backward.

But that is not the most important thing. I think I am best at giving examples because I am not a computer scientist, so this is not ... I am not one of those desktop academics that think these things out. I look at the students and try to find out what they need. And then we do it. COMAL is very pragmatic. We never took in new facilities and new structures until we felt that the students needed them. If they made a lot of mistakes, or if they had to do more work than necessary with details, then maybe an extra facility would make it much easier for them. That is in fact how the parameters were introduced. We discovered of course, that parameters would make it much easier for them, so we introduced them. But not until then.

That is why I'm a mathematician - I hate numbers. As a child, when I found out that you didn't have to use numbers, that you could use letters instead, that was it!

Now, imagine that you have a list on the screen. Say from 10 to 240. You want to insert a line between 30 and 40. No, I think I'll take a better one. You'll have a list from 610 to 700, or, my mental calculation is a little ... that is why I am a mathematician, I hate numbers. As a child when I found out that you didn't have to use numbers, that you could use letters instead, that was it!

OK, you have here some numbers from six hundred something to six hundred something else. You want to insert a line. You know then, if you have to use the line number. Very easy. Instead of saying 615, you write 15 for example. You introduce a wrong number. Later you cannot find that darn line. Finally you see it. What is doing there. It is between 10 and 20. It should be between 610 and 620. What you should be able to do, with or without line numbers, is to move your

cursor up to 620, press CTRL I - the text opens up, and you insert the line. So you get what you see. That's the whole idea. Also, if you put the cursor at 601, press CTRL D, and zip, the line disappears. This is what I am after. This is what I am trying to get the standards committee to accept at the next meeting. I know I'll have a hard time doing it because I know it is very difficult.

I got into an enormous lot of fights and arguments when I came out with the language.

That's another thing I might have told you. I got into an enormous lot of fights and arguments when I came out with the language. In fact, don't expect that people are happy and grateful, for your coming up with this. A lot of people would say: *Why what's this about, we are perfectly OK with what we have.*

There were articles in papers written against me, as though I was some new unknown form of Communist in disguise. It took me some years to understand why people can get mad at you when you come up with new ideas.

A programming language is not just a tool. It is something different and something more.

A programming language is not just a tool. It is something different and something more. In fact, what I was saying to some of these people ... or how I was interpreted was: *You are telling us that we are using bad language.* And that is certainly not a nice thing to tell people. Really! It is! Now I am much more careful not to be too tough. You think the saying comparing BASIC and the Devil was bad enough. Wow. You should have heard the arguments we used in Danish. They are absolutely untranslatable. They never should be anyway.

I hope I answered the question about the full screen.

What you are really after is a full screen editor. The line numbers are neither here nor there.

Well OK. In a 40 column screen it would give you 5 characters more. And sometimes it may prevent the wrap around. But that is minor. And whether the line numbers are going to be there or not is also of a minor concern. The important thing is that you have a full screen editor. You get what you see.

Referring to that problem, not only not being able to find the line that you were trying to insert when you mistyped it. About three days ago, I had one of those. I could not find it. Nothing at all worked. What I did was I double struck one of the keys and it typed in place of a line I had already written and everything went to pot.

Yes, that's right. If you could open up the text, you would know exactly what you were doing. You would see which line was pushed in order to make room for the next.

Well, I've seen a lot of this with my students. Coming up with a program and saying, well I had a program here 15 minutes ago, but ...

I remember, by the way, one experience we had with BASIC programs, and this is a true story again. Long John was the students name. He was almost 2 meters. He was a favorite with basketball. He was also a good programmer, but he came up one day with this, not a very big program. He asked me, in Danish of course, in a fair translation, he asked me the following question: *Borge, could you explain to me why this program works?*

Well, John. We sat down and we found out that three lines were never executed. He jumped around them. We sorted things out ... that was in the old bad BASIC days. He was only one out of a series of similar experiences. Now, if I should put a ... I could hardly use the good English work BASIC any more, but a basic philosophy, it would be the following: **Computers should be as easy to use for human beings as possible.**

We should be controlling computers, not the other way around. This was what was behind us all the time when we made COMAL.

We should be controlling computers, not the other way around. This was what was behind us all the time when we made this [COMAL]. Benedict Lofsted, the first one ... he was not in the second project because he went to Greenland, and that's a long ways from Denmark to Greenland. So, I had to the second project all alone. But it was not that

difficult, because it appeared that the first definition was so well designed that we could enhance it, extend it, without violating the original idea.

COMAL can take extensions without the original concept being ruined. Maybe that is why you like the language.

This is one of the other things, I hope you agree, that it still appears that COMAL can take extensions without the original concept being ruined. Maybe that is why you like the language in fact ... is the regularity in it ... or as a computer scientist would say, the orthagonality of it. I tried to learn that word.

One problem I have as my program gets growing to some length, that you start forgetting procedure names and things like that. Is it possible to have a window or something which could list the procedures that you have going at this point?

Yes. What you are asking is a list of the symbol table, of the variable names and the procedure names, probably with some indication of where they were to be found. We have that in the new CP/M COMAL. We have a LISTSYM or LISTPROC, I forget what we called it. Note that this has nothing to do with the language. This is the environment. And that is what is what we are after now. To make it even more friendly.

Is there a possibility of having certain procedures built in? For example, rounding up or that sort of situation?

Yes, it should be. That is what they are doing with the machine codes, the packages. In fact, you can build in anything. You can make yourself a commercial package.

Also, like COMAL 2.0 has built in graphics, if you want to draw a circle, you just use the keyword circle and its parameters. In 0.14 you have to have a procedure.

In the Mytech [Alder] version ... I hope it will eventually be a good version. You can even write the code [for packages] in the language C. [AmigaCOMAL also allows this] And C is much easier to use than machine code, in case you don't know it. And then use them as COMAL packages. That is to say, that all the procedures you write in machine code can be invoked or called as if they were normal user defined procedures.

I wanted to tell you a couple days ago, but I never got around to it. There is an environment, called artificial intelligence, developed at the University of Suffax, called PopWalk. It works in a screen oriented environment, providing you access to LISP, PROLOG, and POP11... that's the three languages. What I thought was extremely powerful, is that you could link to it subroutines, procedures, whatever you want to call them, in a host of other languages, including Pascal, Fortran, C. That strikes me as being extremely powerful. Each of these languages have some particular advantage, for some particular applications. Maybe it's the language you happen to know, that's already an advantage. Otherwise the language may be well suited to doing a particular task. So, I really try to encourage the idea that COMAL should be able to access routines compiled in a wide variety of Languages.

By the way, Seymour Papert (of Logo fame) took a look at COMAL, and he liked it!

I don't know whether that could be done, or how feasible it is, but it would be very practical to have it [in 1989 AmigaCOMAL and IBM PC COMAL 3.0 now allow this]. Of course you should be aware, that a language cannot be totally general. There are applications where even COMAL wouldn't cope with. We had a discussion with Seymour Papert, the man who made LOGO. He put out his position, quite clearly that, ... by the way, he took a look at COMAL, and he liked it! ... and he expressed his opinion that even children should try to learn more than one programming language. It will be more like programming concepts that they will be learning about. And it appears also that children are learning these things extremely fast. The robots, which I've brought one or two samples with me, you can look at them later if you like, were programmed by 11 year old children. We had no problems. The teacher had problems. The children had not.

Well, it seems, from what we've learned today of programming languages, that there are really three classes of languages. Each of them fulfill a role that the other ones cannot.

Yes. My guess is that in the future there will only be two. I think that the LISP languages will be taken over by the Logic, the PROLOG type. I think so. The three classes you think of are

probably the algorithmic languages, the LISP kind of languages, and the logic, PROLOG, kind of languages. COMAL is of course, an algorithmic language, it's in the name. LISP languages would be LISP or LOGO, LOGO is a LISP language. The third one would be PROLOG, a language that is mentioned very often, especially when you speak about 5th generation computers, and the competition between the United States and Japan. Who will be there first with this super thing. But I think that eventually you will see that there will be two. The algorithmic languages, they will never disappear. In robotics, they will still perform. Just imagine ADA. ADA is an algorithmic language, which by the way, COMAL would be a very good kindergarten ADA. It could be an introduction to ADA. I really think that. Pascal is an algorithmic language, Algol, etc. Whereas PROLOG,... and I think it is with PROLOG ... PROLOG has much the same relation to LISP, as Pascal would have to FORTRAN.

Well, the GOTO... Of course, in COMAL there are of course lots of GOTO, but they are hidden. The interpreter is doing them for you. IF, ELSE, ENDIF ... from IF you can jump to ELSE if the condition is not met. This is of course a GOTO, but it is hidden. Because it is being expressed in a way closer to the human language, or the human way of thinking. And the same way I guess that PROLOG would be able to handle lists in a way that would do the same to the list structures that the algorithmic structured languages have done to GOTO. That's my impression. But, OK. I'm sure of one thing. The algorithmic languages are there to stay.

Fortran even.

COMAL is first of all for people who are not professional ... to make it possible for people to program computers even if they were not programming people.

Yes, I think so. But, OK. COMAL is first of all for people who are not professional. I think I wrote in the handbook, to make it possible for people to program computers even if they were not programming people, or something like that. And it appears that it can also be used for some semi-professional, maybe even ...

[interrupts] Paradoxically, I think that the professionals are the fastest to appreciate it.

So much the better.

Of course, the trick is to get their attention. Once they see it, a little exposure to it, they immediately see that it is just the thing.

They have to see it to believe it. They must have a chance to see what COMAL is all about, to see a few examples, a few real programs.

This is probably the most important point you are indicating there. I heard one tonight who tried to introduce COMAL to some teachers somewhere. They have to see it to believe it. They must have a chance to see what COMAL is all about, to see a few examples, a few real programs, before they use it. You can give long talks, even very delicately formulated talks, about it. But there is nothing like a short example. You will see that, if you want to tell people about COMAL, you will have to show them a program in COMAL, and let them see the syntax, the error messages they get immediately, and the indentation that shows them... Let them look at an IF .. THEN .. ELSE, and REPEAT .. UNTIL, simple things, procedures can come later. As soon as they have seen that, they will know what it is about.

Now, I am running out of words. I can feel it. But don't hesitate to ask questions if you like.

Being one who has almost next to no experience in COMAL programming, I was interested if you could elaborate on those three levels of programming language that you just mentioned.

I could, but I am afraid it would be too technical. Do you know about LOGO and PROLOG. I would gladly do it afterwards. It is quite technical. The only thing I can say is, COMAL is a very typical algorithmic language. And if you want to know about a LISP language, the easiest way would be to look into LOGO, not at the turtle graphics! Because that has really nothing to do with LOGO. You can do turtle graphics in any language. You see it in USD Pascal for one. That was a real sensation. That he [Kenneth Bowles] used turtle graphics to train university students. And probably what made USD Pascal so popular.

You'll have to look into the data structures. LOGO is not using arrays like COMAL is. DIM a(10) or

whatever it would be. LOGO is using so called lists, which are more or less what mathematicians would call sets. PROLOG is totally different. It is the language that uses relations. It is more or less abstract algebra.

I have a simple question. Could you relate all the computers that you know that run COMAL now. We'll give you ten minutes.

Oh no. That would be boring.

No. I understand that there are some foreign computers. I would just like to know.

Well, in Denmark we have the old Z80 based microcomputers, which would look very much like Cromemco or IMSAI or whatever. In fact, Comet would look very much like the IMSAI, although the IMSAI used 8080 as far as I know. Then there are new ones coming up now, based on the 8086. Piccolo, and another one called Partner. More or less PC clones. And the Swedish Compis, which is the one Mytech [Alder] COMAL could be used on, also a 80186 based computer. Then the English Amstrad is one you may not know about. Apple has a COMAL in fact, Metanic COMAL. You have never seen that. It is not very good, I would not recommend it. A new one is being implemented right now. But only if the Apple has a Z80 card (CP/M). Then there will be PC COMAL of course. And the VAX computer. And Wicat. I don't know much about that, only that there is a COMAL for it. And Mytech [Alder] claim that they have one for the Mac. They call it MacCOMAL. Whether that is true or not, I don't know, I never saw it. [it is true ... we have seen the beta test of it working]. And I hate to speak about things I have not seen. Because in this branch, rumors ...

Have you considered introducing a help facility in the COMAL environment.

I hope that COMAL will go on developing. But you should expect it to be more in the environment.

Yes, Mytech [Alder] has a HELP. And the new Z80 version has a HELP. In fact the first test versions were running right before I left Denmark. This will be another thing that will be taken up by the Standardization Group. It is more or less the environment again. And it would be very useful I agree. I hope that COMAL will go on developing. But you should expect it to be more in the environment. The language as such I think is probably more or less finished. The definition is closed. There will not be added many more facilities. There are a few things, such as functions. You know that in 0.14 a function can return integers or reals, but not strings. Whereas in 2.0 functions can return strings. In Mytech [Alder] a function can return vectors, which might be an improvement in the language itself. Otherwise it would be to make it more and more user friendly.

What is the Mytech [Alder] version based on?

It is written in C. This means it can run on any computer that has a C compiler. Probably it would be very easy to do, if they haven't got one already, a 68000 version. We are trying to persuade them to put it on the Amiga, whenever that appears.

I've seen advertisements for PROMAL. Is that related to COMAL at all?

Not at all. I saw a German review of it. In Germany COMAL is very well know and is used extensively in many schools. The reviewer started to point out explicitly that PROMAL has nothing to do with COMAL.

Coming back to a point raised earlier. How about the possibility of compiling functions and procedures written in COMAL; compiling them directly into machine code. Once it works, it works forever, and then it runs a lot faster.

That would be a thing that probably anyone would like to have, a COMAL compiler. You would have something like the perfect system then.

That would of course be a thing that probably anyone would like to have, a COMAL compiler. You would have something like the perfect system then. The interpreter to develope interactively the program, to test it. As soon as the program runs as it should, you would take the program and compile it. It should be very easy to do, and I hope that someone will do it.

Let's let Borge get some rest.

Editor's Disk

I came home after work on Sunday night, June 4, ready to rush down and sign onto QLink for our First Sunday of the month COMAL meeting. My mail included a large envelope from Denmark. A quick glance at it set me wondering. I often get large envelopes from Denmark ... that is the main source of COMAL and its developers! However, the envelopes are always hand addressed. My address on this envelope was typed. It was from **Tonder Statsseminarium** ... that's Borge's School! My apprehension was confirmed, for opening the envelope I found another envelope ... the one I had just sent to Borge ... unopened with a short note attached to it. This is what the note said:

> *COMAL Users Group: Letter to Borge Christensen return. We are sorry to tell that Borge Christensen has died on the 13 of May.*

Needless to say, that was a sad day, and a sad meeting on QLink. That envelope, with the note still attached to it is being saved, even though seeing it brings a tear to the eye.

Borge Christensen, father of COMAL, was a great man. Some of you may have been fortunate to have heard his talk at the MARCA Commodore Computer Show ... or in California, when he gave the talk whose transcript precedes this column. Borge was quite a speaker! He was interesting! Even exciting! If you were not lucky to have heard him speak, you still have a chance. You can get a video tape of his talk in California. It is a home production (not a slick commercial product). It is available from **Mitch Pilchuk, 102 Evergreen St, Sterling, VA 22170** for just $15 (VHS tape only). Thanks to Norm Pollinger for taping the talk! We also filled one Amiga disk full of digitized pictures of Borge from this talk. All Amiga COMALites will want a copy of this disk.

Tribute: We are putting together a disk in tribute of Borge. If you want to contribute to it, send in your program, package or text file right away. Mark it clearly TRIBUTE submission. And, yes, that is Borge on the cover of this issue.

Directories: You don't realize how much is on some of the disks until you look at its directory! Nearly one full page of tiny print for just the AmigaCOMAL disk!

Networks: get COMAL support on QLink, PLink and soon CompuServe. We're printing free ads for each in this issue for your info.

Challenge: Let's put some fun back into programming! A programming Challenge. Any computer! Any language! Since COMAL makes programming easier, we should have the advantage, right? Tentative schedule: 1st night of each month; 9pm Central time; COMAL Conference area; PLink and/or CIS. **We need you on COMAL's team!**

Easy: This issue includes virtually our whole COMAL Information Booklet! Many subscribers may not have even seen our 24 page booklet we send out free to those who send us a SASE asking for info. Now you have it (pages 12-33). Feel free to copy any of those pages for club newsletters. A disk with the text files also is available if you want to put any of the files on a local BBS or reformat them into that required by your newsletter.

AmigaCOMAL Ships: The wait is over! The price is under $100 as promised. See a sample page from the manual on page 68. **We urgently need COMAL programs for Amiga ... if you convert any COMAL Today programs to Amiga, please send us a copy on disk.**

New Textbook: A new 300 page textbook should be shipping by the time you get this. It applies to the newest Amiga and IBM COMALs as well as Power Driver and C64 cartridge. If you want the answers you can get a matching disk (specify what computer format!). See a sample page from the book on page 69.

Power Driver Compiler: Released as ShareWare (on *Today Disk #25*, plus you can download it from QLink & PLink). If David Stidolph gets enough response from the ShareWare he will do an update with even more features.

Doc Box: Only a few left. Since a minimum order is 1000, we will not stock them after we run out. They are available from office supply stores (but at a higher price).

New Laser Printer: We want our newsletter and new books to look good. Thus we are getting a new LaserJet IIP printer with a Super Cartridge 2. This will let us print in 11 point Times Roman (this is 10 point) plus **Helvetica** twice the size we have now for titles. Plus it will allow better graphics! We're counting on your support in the coming months so we can pay for the printer.

Free Contributor Disks: If we use your program or article in *COMAL Today* or on a *Today Disk*, you get a free disk of your choice from the left column of the DISKS page of the order form. Just send us a note specifying what we published of yours, and what disk(s) you want in return. This includes all issues since #24. ■

What Is COMAL?

COMAL was designed with the **beginner** in mind, including many interactive features. It is tolerant of mistakes, yet discourages bad habits. This allows a beginner to develop skills necessary in advanced structured programming languages, such as, well, COMAL. The widely acclaimed **turtle graphics** are an integral part of COMAL, and have been for nearly a decade (see page 18).

Advanced programmers also pick COMAL as their language of choice. They utilize the many advanced and powerful features of COMAL that beginners do not need to even know about. However, as beginners' programming skills improve, COMAL always presents even more power and features for them to use.

Let's examine some features that attract beginning programmers and keep advanced programmers.

In direct mode, you interact directly with the computer. You type in a command and COMAL responds right away. A beginner usually starts with a **PRINT** statement. The **PRINT** statement tells the computer to display a message on the screen. This is an important command. Would you want a program to calculate your mortgage payment if it couldn't tell you the answer? In its simplest form, the **PRINT** statement can display a text constant. For example, type:

```
PRINT "hello"
```

and COMAL responds with:

```
hello
```

COMAL is also good with calculations. When you balance your checkbook, COMAL can help. If your starting balance is $313.76 and you wrote two checks ($250.00 and $125.98) type:

```
PRINT 313.76-250.00-125.98
```

COMAL immediately responds with:

```
-62.22
```

No wonder that check bounced. Actually, a useful program is usually harder than this. But don't worry, COMAL helps you in many ways.

COMAL provides a full screen editor to help you write programs. You don't have to load a special program to use this editor. Just type in the program lines from direct mode as described above. A program line consists of a line number followed by a statement. With its AUTO command, COMAL can provide the line number for you. You just type in the statement.

COMAL's editor doesn't sit around watching you type either. It tries to figure out what you are telling it. If it doesn't understand, it will tell you right when you enter the line! Often it offers advice on how to fix mistakes. This is when you will like COMAL's insert, delete, and cursor features. You don't retype the entire line, just the corrections.

I can hear you saying, "*Ok, COMAL is friendly, but what can it really do?*" The power of COMAL comes from its commands, file handling ability, and program structures.

You have already seen the **PRINT** command. COMAL provides several commands to deal with numeric and text data. The data can be provided to a running program from **DATA** statements in the program, from a file stored on disk, or by the person using the program. COMAL supports all the usual math operators such as addition, subtraction, multiplication, and division. It also knows logarithms, trig functions, two methods for generating random numbers, and a lot more. Text strings may be added together or have sub-strings extracted from them. A built-in string search even tells the position of one string within another if there is a match. Comparison operators allow strings and numbers to be sorted. Numbers can be converted to text format and back again.

COMAL supports two kinds of data files. Sequential files read data from start to finish. You can write to sequential files or read from them, but not both at the same time. Random access files are good if you store lots of records together, but only access a few at a time. You can read any record, update the information, and write it back. You don't have to start at the beginning of the file.

Normally, COMAL uses the screen for all its output. But a special option redirects **PRINT** statements to your printer or even a disk file. You **SELECT** the output location. Later, you **SELECT** the screen again.

Easy so far! But it is COMAL's structures that simplify programming and keep advanced users from switching to another language. COMAL has four loop structures, two conditional branching structures, named procedures and functions with parameters, and an error trapping structure. They are illustrated on page 28. AmigaCOMAL and the newest IBM PC COMAL 3.0 also include a powerful RECORD structure and POINTERs.

The loop structures execute one or more consecutive statements over and over. Most loops have a one-line short form.

The **REPEAT** and **WHILE** loops are similar. Both loop an indefinite number of times. The difference is when they decide to stop. The **REPEAT** loop places its test at the end of the loop. Thus the statements inside the loop will always be executed at least once. The **WHILE** loop places the test at the start, so it is possible to skip the statements inside altogether.

COMAL also includes the **FOR** loop. It counts from a starting value to the terminating value. This not only lets you specify the exact number of times the loop should execute, but also gives you a counter to use for other things.

The last loop structure is **LOOP**. Like **REPEAT** and **WHILE** loops, the statements inside are executed an indefinite number of times. However, it's **EXIT** is from the middle, not the ends.

The conditional structures choose one section of code over another based on a comparison. A multi-line **IF** structure has its primary test on the first line (optional **ELIF** secondary tests are also allowed). If the test is true, its statements are executed. Otherwise, an **ELSE** section is executed (if you include it). A one-line **IF** is also available.

The **CASE** structure evaluates one expression at the start (either a number or a text string). The value is compared to the values in the **WHEN** statements. If the main expression value matches a value in a **WHEN** statement, the section of code below that **WHEN** statement is executed. If there is no match, the section of code below the optional **OTHERWISE** statement is executed.

COMAL automatically indents lines within structures for you! It also capitalizes keywords and puts variable names in lower case. This makes it easy to follow the program.

COMAL also allows you to store program segments on disk. You recall them into future programs using the MERGE command. Lines are renumbered automatically to fit the new program.

COMAL is a powerful language. However, no language can include everything. That's why COMAL includes the possibility to extend itself. You can write long routines, give them names, and call them with a single command, just like a **PRINT** statement. These routines can be called from direct mode or a running program. These are procedures and functions.

A procedure is usually a set of statements that work well together. Information can be transferred to and from procedures through variables called parameters.

Functions are like procedures -- multi-line structures which can have parameters and are called with a single statement. The difference is that unlike a procedure, a function also returns a value (string or numeric) to the statement which called it.

Don't overlook COMAL's error handling structure. A language which permits interaction with a user should anticipate the possibility for errors which are difficult to resolve. A classic example is division by zero. Many languages give you two choices: test every expression before it has a chance to cause an error, or let the system crash. The first method has two drawbacks: it slows program execution and the test itself may cause a crash.

COMAL gives you a third choice - utilize its Error Handler! This structure can be used to minimize the effects of errors. The Handler can't create the data in a missing file in the case of a file not found error, but it can give you a second chance to put the correct disk in the disk drive. Since the Error Handler is a true structure it is easy to use. Advanced programmers can utilize it fully, complete with nested Error Handlers.

Finally COMAL can be extended and expanded indefinitely with packages. Beginners can use packages without knowing how they are created. Advanced programmers will find packages an exciting way to tailor the COMAL system to their needs. Now even beginners can try their hand at writing packages since AmigaCOMAL allows you to write a package in COMAL (or in Assembler or C).

The above description is not a complete review of COMAL, but should give you an idea of what to expect. All COMAL 2.0 implementations are compatible and include these features (see the chart on page 18). Plus each adds its own special characteristics (such as mouse, windows and speech in AmigaCOMAL). Trace commands are often included to help follow program flow. Some of these enhancements are mentioned in the separate reviews of the different implementations.

The one exception is Power Driver for the Commodore 64. It includes virtually all of Common COMAL, yet you are permitted to give away copies of it! It lacks packages, error trapping, LOOP structure, and external procedures. Also, user defined functions can only be numeric. ■

Permission granted to copy any or all of these COMAL information pages.

(pages 12-43)

We can provide user groups with multiple copies of these pages as a booklet for distribution at meetings.

Each of the articles in this set is also available as a text file on disk. This allows newsletter editors an easy way to include information in their newsletter, using their special formats. ■

How To Do It In COMAL

How to see what is on a disk:

Put the disk into the drive. Type:
CAT or **DIR**

How to retrieve a SAVEd program from disk:

Put the disk into the drive. Type:
LOAD "name"

How to retrieve an ASCII program file:

Put the disk into the drive. Type:
ENTER "name"

How to run a program that is in the computer:

Type the command:
RUN

How to run a program from disk:

Put the disk into the drive. Type:
RUN "name" or **CHAIN "name"**

How to look at a program:

If the program is not in the computer, retrieve it first. To see the program in the computer type:
LIST or **DISPLAY**

How to store the current program to disk:

Type the command:
SAVE "name"

How to list the current program to the printer:

The program must be in the computer. Type:
LIST "lp:"

How to store program lines as an ASCII file:

Example, to store procedure **pause**, type:
LIST pause "pause.lst"

How to merge procedures into other programs:

Example, to merge **pause** into current program:
MERGE "pause.lst"

How to renumber a program:

To restore lines numbered by 10's type:
RENUM

How to add lines to the end of a program:

The program must be in the computer. Type:
AUTO (now type in the lines)

How to write a new program:

Type the commands:
NEW
AUTO (now type in the program)

How to add lines in the middle of a program:

The program must be in the computer. Locate the place you wish to add a line. For example:
0040 PRINT "Welcome to my program."
0050 PRINT "Hope you enjoy it."

Use a line number between the lines. Type:
45 PRINT "Written just for you."

How to erase lines in a program:

Find the line number of the line to be erased (line 80 in this example). Type:
DEL 80

You may delete a block of lines all at once. Find the first and last line numbers in the block of lines (lines 500 through 750 for this example), then issue the DEL command:
DEL 500-750

You also may delete a procedure or function by name. Type:
DEL name

How to exit COMAL:

To return to the main operating system, type:
BYE or **BASIC** //C64

How to transfer a COMAL program:

Make sure the program is the current program in memory. Store it to disk as an ASCII file. Type:
LIST "name.lst"

Transfer the file to the proper disk format for the other computer (use a conversion program, network, BBS, or direct connect cable).

Retrieve the program into the other COMAL. Type:
ENTER "name.lst"

Note: Power Driver includes a substantial subset of the features.

Disk conversion programs available:

- Big Blue Reader for C64/C128 with 1571/1581 (reads/writes IBM PC and CP/M formats).
- PC Util2 (on our boot disks) and CrossDos for Amiga (reads/writes IBM PC 3.5" disks).
- Access64 and The 64 Emulator for Amiga (hook your 1541, 1571, or 1581 to the Amiga). ■

Common Questions and Answers

Question: What computers can run COMAL?
Answer: Commodore 64, Commodore 128, PET, CBM 8032, MS-DOS, IBM-PC and PS/2, Amiga and CP/M computers. An implementation is under way for Apple IIe/IIc. There are several more versions available in Europe, including Unix, BBC, Acorn, RC, and Compis.

Question: Do you put out a newsletter?
Answer: Our COMAL Today newsletter is the source of up to date information about COMAL. Contributions come from leading COMAL experts as well as users world-wide. Membership is not currently available, but a subscription to COMAL Today is virtually the same thing.

Question: Are your disks copy protected?
Answer: Absolutely NOT! You may make backup copies for your own use. In fact, C64 Power Driver may be given away, as can the Demo disk for CP/M COMAL. You are not allowed to give out copies of the other COMAL system disks, but you can distribute or sell your own COMAL programs.

Question: Is a COMAL compiler available?
Answer: The reason most implementations of COMAL are so fast is that they all are semi-compiled as you enter the program! In addition to this, most versions of COMAL include a Run Time Compiler, with many advantages. A true compiler is not yet available. However, the Run Time system turns COMAL programs into stand-alone files that can be run without the need of COMAL. Thus you can distribute your COMAL programs to every user, not just those who own COMAL.

Question: Do you recommend that students start with COMAL and progress to LOGO or BASIC?
Answer: Yes! By all means start with COMAL. But No! LOGO and BASIC are not needed once you are using COMAL. BASIC is a step backwards and will only give students bad habits to UNlearn later. And COMAL includes virtually all of BASIC, without its hassles. LOGO is usually chosen for its Turtle Graphics - and these are included in many COMALs. COMAL is the natural and official first language taught in five European countries.

Question: How about sample programs?
Answer: Over 4000 programs on are available on more than 50 different disks for the C64. Many of these are being converted to disks for the new COMAL implementations.

Question: Can a BASIC or LOGO program run under COMAL?
Answer: No. However, it can be rewritten to do so. Likewise, BASIC and LOGO cannot run a COMAL program.

Question: Is COMAL Commodore and IBM approved?
Answer: Yes! It was approved by Commodore England. Commodore Canada introduced it at the World of Commodore Show, giving away over 500 COMAL disks in two days. The COMAL Handbook was approved by Commodore USA. The COMAL Cartridge is manufactured by Commodore Denmark. IBM PC COMAL was produced by IBM Denmark.

Question: Will a Common COMAL program I write on my Commodore 64 run on IBM or Amiga?
Answer: Yes. We use a COMAL program to process orders here. It was written on a Commodore but is now running on an IBM PC compatible with 20 Meg Hard disk. We only had to change the file names and remove one short cut in substrings that Commodore allows but IBM does not.

Question: COMAL lacks the left$, right$, and mid$ functions. Can I do substrings?
Answer: Yes. To get a portion of a string just include the position of the first and last character within the string. Example:

```
part$:=text$(start:ending)
```

See page 20 for more string information. ■

What Do They Say?

"If languages interest you, this one is well worth a look... You may find that it's just what you have been looking for." *Jim Butterfield, COMPUTE!*

"COMAL was just what I was looking for." *Colin Thompson, RUN*

"I can recommend a better, faster, and cheaper programming language ... COMAL, the most user friendly language around." *Mark Brown, INFO*

"Combines some of the best features of languages like Logo, Modula, Pascal, and Ada in an easy to use format." *Ahoy!*

"I don't have enough space to list all the good points!" *Noland Brown, Midnite Software Gazette*

"COMAL is the optimal educational computing language." *Jim Ventola* ■

FREE FORM DATABASE

This database program displays brief instructions and asks for your text input. Everything you type before the last character on a line is considered data. The last character is the command. Thus what you type resembles an English sentence.

- End your line with a period, and the data is written to the file.
- End with a ? and a text search starts.
- Type just a ? for a full listing of the file.
- Type just a @ to quit.

An example RUN is included below. Text the user types is underlined, the computer response is in *italics*, explanations are in «small print».

RUN
«file is created»
> COMAL is nicer than BASIC.
«text is added to file»

> Len Lindsay is Captain COMAL.
«text is added to file»

> nicer?
COMAL is nicer than BASIC.

> Len Lindsay: 608-222-4432.
«text is added to file»

> COMAL?
COMAL is nicer than BASIC.
Len Lindsay is Captain COMAL.

> ?
freeform.dat.
Demo.
COMAL is nicer than BASIC.
Len Lindsay is Captain COMAL.
Len Lindsay: 608-222-4432.

> @
«program ends»

Power Driver does not have an error handler. The following replaces the last PROC in the program:

```
PROC filecheck(filename$,filenum) CLOSED
  DIM d$ OF 2 // only want first two characters
  OPEN FILE filenum,filename$,READ // try opening it
  d$:=status$ // get the status of the disk drive
  CLOSE FILE filenum
  IF d$<>"00" THEN // "00" (two zeros) means it exists
    OPEN FILE filenum,filename$,WRITE // create it
    WRITE FILE filenum: filename$,"Demo" //first record
    CLOSE FILE filenum
  ENDIF
ENDPROC filecheck
```

Read the first column on the next page for info on how to enter this same exact program into any COMAL. (hint: line numbers are required for COMAL programs, but /AUTO will provide them for you as you type):

```
PAGE // clear the screen
PRINT "Free Form Database by Joel Rea"
PRINT "Last character is the command:"
PRINT "   .-- add to file,"
PRINT "   ?-- search file,"
PRINT "   @-- exit program."
DIM line$ OF 80, text$ OF 80
DIM filename$ OF 20, command$ OF 1
filename$:="freeform.dat"; num=7 // file specs
filecheck(filename$,num) // if file not exist, create it
REPEAT
  get'line'from'user
  CASE command$ OF
  WHEN "." // period
    add'line'to'file
  WHEN "?"
    display'matches
  OTHERWISE
    NULL // do nothing
  ENDCASE
UNTIL command$="@"
END // optional end statement
//
PROC get'line'from'user
  PRINT // blank line
  REPEAT
    INPUT "> ": line$ // user types in something
    max:=LEN(line$) // length of input
  UNTIL max>0 // must enter something
  command$:=line$(max:max) // just last character
  IF max>1 THEN // more than just a command
    line$:=line$(1:max-1) // remove last character
  ELSE
    line$:="" // only a command, no other text
  ENDIF
ENDPROC get'line'from'user
//
PROC add'line'to'file
  OPEN FILE num,filename$,APPEND
  WRITE FILE num: line$
  CLOSE FILE num
ENDPROC add'line'to'file
//
PROC display'matches
  OPEN FILE num,filename$,READ
  WHILE NOT EOF(num) DO
    READ FILE num: text$
    IF line$="" OR line$ IN text$ THEN PRINT text$,"."
  ENDWHILE
  CLOSE FILE num
ENDPROC display'matches
//
PROC filecheck(filename$,filenum) CLOSED
  TRAP // check if the file exists
    OPEN FILE filenum,filename$,READ // try opening it
  HANDLER // if file does not exists we drop down here
    OPEN FILE filenum,filename$,WRITE // create file
    WRITE FILE filenum: filename$,"Demo" // first record
  ENDTRAP
  CLOSE FILE filenum // close the file from either open!
ENDPROC filecheck
// Power Driver does not have TRAP ... HANDLER
// replace the above procedure with the one on the left
```

Free Form continued...

It is easy to enter a COMAL program. COMAL helps you out every step of the way. Before you start a new program, erase any current program. Type:

```
NEW   «Enter»
```

After each line, hit the «Enter» key (labeled «Return» on some computers).

COMAL programs require line numbers. However, we list them without line numbers since you can use AUTO mode to enter the program. Type:

```
AUTO
```

COMAL will respond with:

```
0010 ■
```

The cursor is after the line number 10. You just type the first program line and hit «Enter». COMAL then prompts you with the next line number:

```
0020 ■
```

Type each line in the program in this manner. COMAL will help you. Don't type in the spaces to indent the lines. COMAL does that automatically for you. No need to capitalize the keywords. COMAL will do that for you too. Don't type the name after ENDPROC. COMAL will add it for you later. If you make a mistake, COMAL will offer you advice.

After typing all the lines, stop AUTO mode (varies by computer):

```
Power Driver:          Hit «Return»
                with nothing on the line
C64 Cart:              Press «STOP»
Amiga:                 Press «Esc»
CP/M:                  Press «Esc»
IBM:                   Type «Ctrl» + «C»
```

Before you try out the program store it on disk to be safe. If anything goes wrong (lightning strikes), you can reload the program from disk. Type:

```
SAVE "freeform"
```

Now run the program (see sample on the previous page). Make sure you have the program in memory before continuing!

Routine Stealing!

This is a COMAL specialty. It is easy for you to steal routines (called procedures or functions) from other COMAL programs, and merge them into a new program you are writing!

To do this just store the routine to disk in ASCII text form (with the LIST command). To merge it with a future program use the MERGE command. As an example let's store the procedure FILECHECK:

```
LIST filecheck "filechk.lst"
```

Power Driver does not list routines by name, only by line range. Therefor, you must first find the starting and ending line number of the routine. It also uses its ENTER command to do the MERGE later, so it is best to renumber the lines into the 9000 range. Do this:

```
RENUM 9000,1
LIST 9052-9062 "filechk.lst" ■
```

Phone Book, Phase 1...

Now you are ready to try the second program, doing some routine stealing! First erase the current program. Type:

```
NEW
```

As before, the AUTO command gives you line numbers. Type:

```
AUTO
```

Now just enter the program as shown in the next column. When you get to the end, stop AUTO mode (see previous column).

Now we will merge the routine we are stealing from Free Form Database. Type:

```
MERGE "filechk.lst"
```

COMAL will automatically renumber the lines as they are merged into the program!

Power Driver does not have MERGE. It uses ENTER instead, and does not renumber the lines for you. Type:

```
ENTER "filechk.lst"
```

The program is now ready to SAVE and RUN. However, to satisfy your curiosity, list it to see the merged procedure:

```
LIST
```

Electronic Phone Book

```
DIM name$ OF 20,phone$ OF 12
DIM filename$ OF 20
filename$:="phone.dat";num:=5//filespec
filecheck(filename$,num) // check on file
REPEAT
  PRINT "e=enter f=find l=list q=quit"
  CASE INKEY$ OF
  WHEN "e","E"
    enter'name
  WHEN "f","F"
    INPUT "What name? ": name$
    search'for(name$)
  WHEN "l","L"
    search'for("")
  WHEN "q","Q"
    END // This ends the program here!
  OTHERWISE // not valid key
    PAGE // clear the screen
  ENDCASE
UNTIL TRUE=FALSE // forever
//
PROC enter'name
  INPUT "Enter name:  ": name$
  IF name$>"" THEN //name required
    INPUT "Enter phone: ": phone$
    add'to'file
  ENDIF
ENDPROC enter'name
//
PROC add'to'file
  OPEN FILE num,filename$,APPEND
  WRITE FILE num: name$,phone$
  CLOSE
ENDPROC add'to'file
//
PROC search'for(search$)
  OPEN FILE num,filename$,READ
  WHILE NOT EOF(num) DO
    READ FILE num: name$,phone$
    IF search$="" or search$ in name$
      PRINT name$,TAB(21),phone$
    ENDIF
  ENDWHILE
  CLOSE
  PRINT "Hit <return> when ready."
  WHILE inkey$<>chr$(13) DO NULL
ENDPROC search'for
«stop AUTO mode here, see left side»
```

Here's a sample of what it does:

```
RUN
e=enter  f=find  l=list  q=quit
e
Enter name: Captain COMAL
Enter phone: 608-222-4432
e=enter  f=find  l=list  q=quit
e
Enter name: Emergency
Enter phone: 911
e=enter  f=find  l=list  q=quit
l
phone.dat              Demo
Captain COMAL          608-222-4432
Emergency              911
Hit <return> when ready.
e=enter  f=find  l=list  q=quit
f
What name? COMAL
Captain COMAL          608-222-4432
Hit <return> when ready.
e=enter  f=find  l=list  q=quit
q ■
```

TURTLE GRAPHICS

Turtle Graphics were what made LOGO popular, yet COMAL has had a faster turtle for years! These Turtle commands work on all our COMALs:

BACK : move turtle backwards
```
back(«length»)
back(50)
```

BACKGROUND : set screen background color
```
background(«color number»)
background(2)
```

CLEAR : clear the graphics screen
```
clear // also can use clearscreen
```

DRAWTO : draw a line from current point ¤
```
drawto(«x coord»,«y coord»)
drawto(50,80)
```

FILL : fills in area with current color ¤
```
fill(«x coord»,«y coord»)
fill(50,80)
```

FORWARD : move turtle forward
```
forward(«length»)
forward(100)
```

GETCOLOR : returns color of specified pixel
```
getcolor(«x coord»,«y coord»)
print getcolor(50,80)
```

GRAPHICSCREEN : turn on graphic screen
```
graphicscreen(«mode») //Power Driver use:
graphicscreen(0)      //SETGRAPHIC(«mode»)
```

HIDETURTLE : make turtle invisible
```
hideturtle
```

HOME : put the turtle in its home position
```
home
```

LEFT : turn turtle left
```
left(«degrees»)
left(90) // a right angle
```

MOVETO : move to loc without line ¤
```
moveto(«x coord»,«y coord»)
moveto(50,80)
```

PENCOLOR : set turtle drawing color
```
pencolor(«color number»)
pencolor(2)
```

PENDOWN : put pen down, turtle draws
```
pendown
```

PENUP : pick pen up, turtle does not draw
```
penup
```

PLOT : plot a point in current color ¤
```
plot(«x coord»,«y coord»)
plot(50,80)
```

PLOTTEXT : put text on graphics screen ¤
```
plottext(«x coord»,«y coord»,«text$»)
plottext(0,24,"press space to continue")
```

RIGHT : turn turtle right
```
right(«degrees»)
right(180) // reverse direction
```

SETHEADING : set turtle heading
```
setheading(«degrees»)
setheading(180)
```

SETXY : set turtle x, y coordinates ¤
```
setxy(«x coord»,«y coord»)
setxy(50,80)
```

SHOWTURTLE : make turtle visible
```
showturtle
```

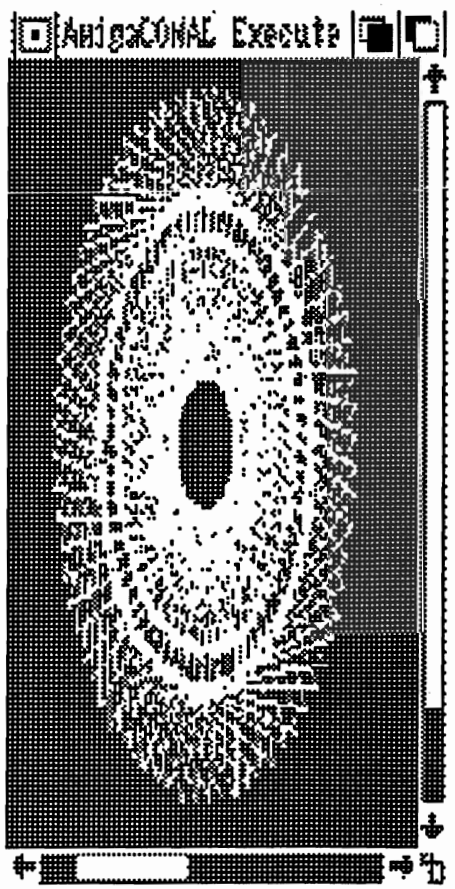
TEXTSCREEN : turn on text screen
```
textscreen //Power Driver use SETTEXT
```

TURTLESIZE : set turtle size (0 to 10)
```
turtlesize(«size»)
turtlesize(6)
```

¤ = Power Driver does not use ( ) parentheses. ■

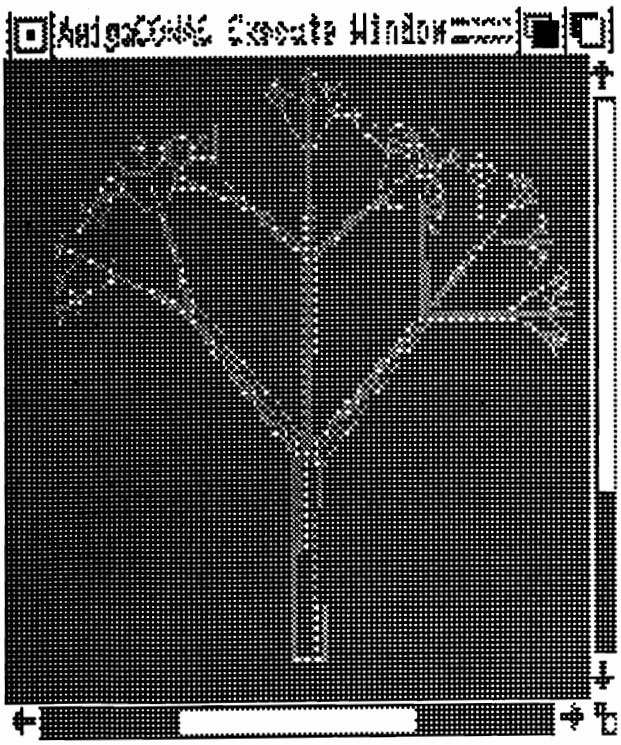
SPIROLATERAL

The screendump below is from AmigaCOMAL. The program (top of the next page) will run on all COMALs. Rod Graham presented this program in *COMAL Today #4*. He said students in his class would rather play with this program than **Frogger**.



Spirolateral: The Program

```
USE turtle // Power Driver use SETGRAPHIC(0)
hideturtle
nowrap // Power Driver omit this line
DIM sequence$ OF 10 // limit R and L sequence to 10
REPEAT
  textscreen // Power Driver use SETTEXT
  page
  PRINT "Once running, press Q to Quit"
  PRINT "or any key for the next segment."
  PRINT AT 4,1: "Try   size=20   angle=127"
  PRINT "and   sequence=RRRRR"
  INPUT AT 7,1: "What size (0=Quit): ": length
  IF length<=0 THEN END // end it here if 0
  INPUT AT 9,1: "What angle: ": angle
  INPUT AT 11,1: "Sequence of R and L: ": sequence$
  graphicscreen(0) // Power Driver use SETGRAPHIC
  home
  clear
  REPEAT
    FOR seq=1 TO len(sequence$) DO
      forward(length*seq)
      CASE sequence$(seq:seq) OF // one char substring
      WHEN "r","R"
        right(angle)
      WHEN "l","L"
        left(angle)
      OTHERWISE
        null // error in sequence input
      ENDCASE
    ENDFOR seq
  UNTIL done // see the function DONE below
UNTIL TRUE=FALSE //forever, see END in the INPUT section
//
FUNC done CLOSED
  DIM keypress$ OF 1
  keypress$="" // init
  WHILE keypress$<CHR$(1) DO keypress$=KEY$ //look for key
  IF keypress$ IN "Qq" THEN RETURN TRUE //yes they're done
  RETURN FALSE // all other keys
ENDFUNC done
```



Tree: The Program

This program by Phred Linn is taken from *COMAL Today #8*. It runs on all our COMALs. The screendump from AmigaCOMAL at the bottom of the previous column is not as impressive as the screen itself.

```
USE turtle // Power Driver omit this line
graphicscreen(0) // Power Driver use: SETGRAPHIC(0)
hideturtle
length=44; treeangle=44 // try other values for fun!
start=2*(length DIV 20)+4
back(4*start)
limb(start) // the trunk for the tree
tree(length,treeangle)
//
PROC tree(length,angle)
  IF length<2 THEN RETURN // stop the recursion!!
  left(angle)
  limb(2*(length DIV 20))
  tree(length/2,RND(10,70)) //recursive call, random angle
  back(length)
  IF angle>25 THEN
    right(angle)
    limb(2*(length DIV 20))
    tree(length/2,RND(10,70)) //another recursive call
    back(length)
    right(angle)
    limb(2*(length DIV 20))
    tree(length/2,RND(10,70)) //another recursive call
    back(length)
  ELSE
    right(angle*2)
    limb(2*(length DIV 20))
    tree(length/2,RND(10,70)) //another recursive call
    back(length)
  ENDIF
  left(angle)
ENDPROC tree
//
PROC limb(count)
  forward(length)
  right(90)
  FOR x=1 TO count STEP 2 DO
    forward(x)
    right(89)
    forward(length)
    right(91)
    forward(x+0.035*length)
    right(91)
    forward(length)
    right(89)
  ENDFOR x
  forward(count/5)
  left(90)
ENDPROC limb ■
```

C64 Power Driver Note:

Graphics commands do not require ( ) parentheses. This was considered better for younger users. Note that any command with only one parameter (such as FORWARD 100 can be issue with or without ( ). The commands with 2 or more parameters must not use ( ). Power Driver also includes many built-in Sprite commands that give you complete control over the sprites without using any PEEK or POKES. ■

People Link & QLink - On-Line COMAL Support

Subj: string func? From: Icarus
Can someone explain strings and string functions, particularly placement of the colons?

Subj: strings From: Captain C
Since BASIC doesn't have user defined string functions, they are unfamiliar to most. Compare them to a built-in function. We talk about SPC$(5) returning 5 spaces:

```
A$=SPC$(5)
PRINT "HI",SPC$(5),"JIM"
HI     JIM
```

See the 5 spaces in the printout. And A$ now is 5 spaces. Next we can write a string function:

```
FUNC jim$(num) CLOSED
  DIM temp$ OF num*3
  temp$="" // start with nothing
  FOR x=1 TO num DO temp$:+"JIM"
  RETURN temp$
ENDFUNC jim$
```

Now, try it: PRINT jim$(3)
JIMJIMJIM

Now, about the colons. Colons are used to specify substrings:

```
A$="BIRTHDAY"
A$(1:3)  would be "BIR"
A$(2:5)  would be "IRTH"
```

The colon just separates the start position from the end position.

Subj: colons From: Comalite J
Think of a string as a one dimensional array of characters:

```
DIM mystring$ OF 6
```

At first, it looks like this:

```
+---+---+
|   6   |  «--MAX (DIMmed Length)
+---+---+
|   0   |  «--Current-Length
+---+---+---+---+---+---+
| @ | @ | @ | @ | @ | @ |
+---+---+---+---+---+---+
  1   2   3   4   5   6
```

Now execute this: mystring$:="Joel"

```
+---+---+
|   6   |  «-- MAX-LEN
+---+---+
|   4   |  «-- CUR-LEN
+---+---+---+---+---+---+
| J | o | e | l | @ | @ |
+---+---+---+---+---+---+
  1   2   3   4   5   6
```

A string's current length can never exceed the max length (specified in the DIM statement). Unlike a numeric array, a string can have an apparent current dimension that is smaller than its actual maximum dimension. Also unlike a numeric array, you can reference the entire string or any contiguous part of it containing 0 or more characters with indexing. Instead of a single number specifying which item of a numeric array to index, we use a RANGE to specify a SUBSTRING:

```
mystring$(start : end)
```

start and end are expressions which evaluate to a value between 1 and MAX-LEN. See the result here:

```
PRINT mystring$(2:3)
oe
```

Characters 2 through 3 of mystring$ ("Joel"), output oe. The expression mystring$(2:3) does this:

```
+---+---+
|   6   |  «-- MAX-LEN
+---+---+
|   4   |  «-- CUR-LEN
+---+---+---+---+---+---+
| J | o | e | l | @ | @ |
+---+---+---+---+---+---+
  1   2   3   4   5   6
      ^   ^
```

Now type: mystring$:+" Rea"
The ":+" assignment appends " Rea" onto the end of mystring$. The result is a string with the value "Joel Rea", but since mystring$ has a MAX-LEN of 6, characters after the 6th character are cut off. So the result is "Joel R". Thus:

```
+---+---+
|   6   |   «-- MAX-LEN
+---+---+
|   6   |   «-- CUR-LEN
+---+---+---+---+---+---+
| J | o | e | l |   | R |
+---+---+---+---+---+---+
  1   2   3   4   5   6
```

Now type: PRINT mystring$(2:4)
The result is "oel", characters 2 through 4 of the string "Joel R". If I just want character 3, I can specify the start and end to both be 3: PRINT mystring$(3:3)
The result is "e".

To reference a substring starting with the first character of a string, you normally specify a start of 1. COMAL has a shortcut: simply omit the start. Just specify the colon and the end. The next two lines are equivalent:

```
PRINT mystring$(:4)
PRINT mystring$(1:4)
```

A similar shortcut is available for substrings which end with the last character. Just specify the first character followed by a colon. The next two lines are the same:

```
PRINT mystring$(3:)
PRINT mystring$(3:LEN(mystring$))
```

which, in this case, is:

```
PRINT mystring$(3:6)
```

The result is "el R".

For a one character substring, just specify the start and end as the same:

```
PRINT mystring$(3:3)
e
```

In COMAL, you can ASSIGN to a substring! For example, assuming mystring$ equals "Joel R", then:

```
mystring$(2:4):="ack"
PRINT mystring$
Jack R
```

Characters 2-4 were changed without affecting the rest of the string. Substrings are padded with spaces to the right if needed:

```
mystring$(2:4):="an"
PRINT mystring$
Jan  R

mystring$(2:):="im V"
PRINT mystring$
Jim V   ■
```

The above is an example of on-line COMAL support. In addition to message boards, there are upload / download libraries of COMAL programs and national monthly COMAL meetings: every first Sunday and second Thursday on QLink; every third Wednesday on People Link (and CIS pending). Meetings are at 9pm Central time.

People Link - to get to our COMAL Support Section just /GO COMAL. To sign up on PLink call 1-800-524-0100. EMail to CAPTAIN C.

Quantum Link - to get to our COMAL Support Section go to CIN; Computing Support; Programmers Workshop. To sign up on QLink call 1-800-392-8200. EMail to CAPTAIN C.

CompuServe - to get to our COMAL Support Section ... GO AMIGAV then LN to find COMAL listed. To sign up on CIS call 1-800-848-8199. ■

COMMON COMAL - Compatible

COMAL is an easy to use, yet powerful language. It is standardized and available for many popular computers. COMAL has become the common ground between popular computers. The chart on page 28 shows the common keywords. The pages following the chart give more details about each keyword, including syntax and an example.

In addition to sharing common keywords, each COMAL system provides the same programming structures (see page 27).

But it goes even further than just keywords and structures. Each COMAL has a compatible **environment.** They all share the same **look and feel**. Once you know COMAL on one computer, you will feel right at home using COMAL on a different computer! They share a common **friendly** environment.

The built-in full screen editor makes program entry easier. If you can see it on the screen, you can edit it. COMAL checks each line you enter -- **when you enter it.** If it sees a mistake it tells you **right away,** and even attempts to help you fix it! The SCAN command checks your entire program to verify the multi-line structures. Before you run your program you will know that each line and structure is proper.

When you LIST a program, COMAL automatically indents the structures for you! It also capitalizes the keywords but shows your variable names in lower case. You get a very readable program listing -- especially if you take advantage of long variable names. You can use names as long as the screen line permits!

COMAL also helps you fine-tune your program. A TRACE facility helps you locate errors. The **Error Handler** allows your programs not only to catch errors, but often to correct them while the program continues running.

You should enjoy writing programs in modules (procedures and functions). You give each one a name, and pass information back and forth with it via parameters. It can be open and share all variables with the main program or be **CLOSED** so that all variables and data inside it are considered local. An **IMPORT** statement allows you access to specific variables if needed. Once you have defined a module, you can call it from direct mode -- just like any other COMAL keyword! You can even call the module from inside itself (called recursion).

Your modules are actually extending COMAL. In fact, a module can be stored on disk as an "external" procedure or function. Any program can then include that module simply by adding a one line "header". COMAL automatically gets the module from disk when it needs it.

Packages are another method of extending COMAL. They are usually written in machine code and are specific to each computer. Part of the beauty of packages is that they allow fast access to hardware dependent features. An even greater advantage is that you call them from COMAL by name, just as if they were part of COMAL itself. You can use existing packages without knowing how they were created.

Normally, the user can stop a program by pressing the break key (usually a «stop» or «esc» key). However, there are times when you want to be sure that the program is not stopped. COMAL allows the break key to be disabled and re-enabled anywhere within a program. Furthermore, it provides an **ESC** flag to notify the program when the user presses the break key.

Since COMAL is available on many different computers, you need a convenient method of transferring programs between them. The MERGE and ENTER commands accept a program stored as an ASCII file. Of course COMAL also provides a way to store program lines in ASCII format: the LIST command! You can LIST your program to any output location: screen, printer, disk file, or even modem. ■

BENCHMARK TIMINGS

We did some quick benchmark tests. The results are shown below. The programs used are referenced under the chart. COMAL is nearly always faster than BASIC. This difference is significantly more dramatic when dealing with strings. Also it seems that AmigaCOMAL is on top between the various COMAL implementations. See also page 26.

System	Ahls	Calc	Trig	Quick	Sieve	Substr
AmigaCOMAL	**3.1**	**7.2**	**4.0**	**3.1**	**6.6**	**0.2**
AmigaBASIC	12.8	16.9	7.1	4.3	16.0	5.1
IBM COMAL 3.0	**9.2**	**27.8**	**26.2**	**17.3**	**3.5**	**0.4**
IBM COMAL 2.2	**10.2**	**32.8**	**26.7**	**17.7**	**8.6**	**0.3**
IBM BASIC	14.4	55.6	46.0	21.5	39.8	9.7
C64 COMAL 2.0	**25.5**	**72.9**	**58.2**	**40.7**	**28.0**	**1.0**
C64 Power Driver	**111.0**	**106.6**	**59.5**	**84.0**	**67.0**	**2.1**
C64 BASIC	115.7	106.4	63.3	86.1	137.4	12.3

Notes:
Ahls = Ahls test from Creative Computing magazine
Calc = Calc test from Byte magazine May 1985
Trig = Trig test from COMAL Today 12 page 38
Quick= Quick test from COMAL Today 12 page 39
Sieve= Sieve test from Byte / COMAL Today 23
Substr=Substring replacement test
Base model Amiga 500 and IBM PC were used for the tests.■

There are two current versions of COMAL for the Commodore 64. They are the most popular versions in U.S.A. and therefore the best supported and documented.

Power Driver is the souped up replacement to COMAL 0.14. It is an introductory version that almost meets the Common COMAL standard, but is lacking in a few areas. However, it is far better than other C64 languages and costs just $9.95 including a 22 lesson interactive tutorial. It includes built-in sprites and turtle graphics.

The COMAL 2.0 cartridge is a full Common COMAL with 11 built-in packages. It's capabilities amaze even professional programmers. It includes sprites, sound, turtle graphics, fonts, and more.

COMAL 2.0 has commands to support virtually every hardware feature on the C64. It has the graphics and sprite commands of Power Driver plus much more. It adds commands to draw circles and arcs. You can change numeric limits of the graphics screen for function plotting. Automatic sprite animation is supported, allowing a sprite to move and change its shape while the program is doing something else; like sound.

There are commands to play a note, and set its frequency, duration and waveform. An entire song can be played by putting the notes and durations into an array and telling COMAL to play it. The tempo will be exact because interrupts are used for timing; you don't need to write delay loops.

Several peripherals are supported. Joysticks, paddles, and lightpens can be used with built-in commands. The modem port can be selected as the default input/output device.

If you'd like to change the C64 character set, the font package makes it possible to redefine the characters. If you create a special font for a game, the font can be saved with the game. Next time it's loaded, your special font is automatically installed!

You have to know assembly language to create a package for C64 COMAL 2.0, but not to use a package. Complete documentation is available, explaining interfacing machine language to COMAL programs. COMAL 2.0 Packages, by Jesse Knight, explains how to create a package. Packages Library, by David Stidolph, on the other hand, explains how to use existing packages (no knowledge of machine language is necessary).

It's even possible to burn your favorite packages into an EPROM and plug them directly into the COMAL cartridge, ready to use every time you turn the computer on. In fact, an EPROM chip called Super Chip is available now. It adds about 100 new commands to COMAL and includes support for the C128.

Power Driver has all of the structures of Common COMAL except **LOOP, packages** and the **Error Handler.** It supports procedures and functions, but not nested or external. Also, user defined string functions are not implemented. The ability to **IMPORT** variables is missing, but procedures and functions do not need to be imported.

Even without the above commands, Power Driver is a powerful language which exceeds others. The graphics commands are among it's best features. The **built-in turtle graphics** allow you to plot points on the graphics screen or draw a line from one point in any direction for any length. You can fill in shapes and mix text with the pictures. 16 colors are supported in hi-res and multi-color modes.

If drawing pictures is not enough, try sprites. You must first define a shape (often from data statements or a file). Once a shape is defined, it can be assigned to a sprite. Then you can display it anywhere on the graphics screen in any color. It is possible to cycle through several shapes to create a cartoon. Motion can be simulated by adjusting the position of the sprite. Up to eight sprites can be shown at once and there are commands to tell if they touch each other. **No peeks or pokes are needed while using sprites.** ■

HOW DOES IT RATE?

Overall Rating	**A**	**Reliability**	**A**
Ease of Use	**A**	**Error Handling**	**A**
Documentation	**A**	**Value for Money**	**A**

COMAL Starters Kit
rated by The Book of Commodore 64 Software

Performance	**10**	**Reliability**	**9**
Ease of Use	**9**	**Documentation**	**8**

COMAL Starters Kit
rated by The Best Vic/C64 Software
(10 is highest possible rating)

Overall rating: * * * * *
C64 COMAL 2.0 cartridge
rated by INFO magazine
(5 stars is the highest possible rating)

Overall rating: * * * *
COMAL Starters Kit
rated by INFO magazine ■

AmigaCOMAL is already my favorite COMAL. It is fully Common COMAL compatible, except LINK is performed by USE (this is actually better).

AmigaCOMAL includes all the fun of Speech and **Turtle Graphics** plus it has the most advanced COMAL features such as RECORDs and POINTERs, plus a more advanced implementation of packages and the error handler. It is **faster** than BASIC, yet **easier** to use and **more powerful.**

AmigaCOMAL has many useful features, over and above the standard friendly COMAL. **TIME$** and **DATE$** are included, as is a built in **TIMER.** When listing a program, you can stop it, and then just by moving your cursor up to the top of the screen, cause the program to be listed backwards to see any lines you might have just missed. Also, when entering a program line, as soon as you hit «Enter» the line is checked for proper syntax. If there is an error, the cursor is put on the point of the error, and a message window pops up. If the line is OK, it is immediately Re-Listed, with proper indentation, keywords in CAPS, omitted words filled in, = converted to :=, and so on.

Packages are a way of extending the COMAL system. Until now, packages always had to be written in Machine Code or Assembler. **AmigaCOMAL allows you to write packages in COMAL** or C as well! Now anyone can add extensions to COMAL, **written in COMAL itself**.

For example, you may wish that COMAL had a FILE'EXISTS function that would check if a file exists, and a TYPE command, to type out the contents of a text file. You can add those extensions to COMAL yourself. We did those two as an example for you, and include the package on the disk so you can see how easy it was (we call the package TYPE). All you have to do is issue the command: USE type and AmigaCOMAL links the commands in our TYPE package into the COMAL system. Once you do that, you can type out any text file in direct mode (or within a program) like this:

```
TYPE("filename.txt")
```

The TYPE command checks with FILE'EXISTS before trying to type out the file, so it is smart. It also can ignore the «carriage return» in files from IBM and C64 (Amiga uses only «line feed» at end of line).

There are many packages on the AmigaCOMAL system disk. To see what new commands are in a package, type:

```
USE packagename
LISTPACK packagename
```

There also is an **insert mode** for program editing, just like with a word processor. You also can open a blank line anywhere on the screen (nice to type in the line you wish to add to the program). Also **FIND** and **CHANGE** commands are included to make it easier to edit your program.

Other nice expanded features include **WAIT**. The command WAIT 5 will wait 5 seconds. The command WAIT will wait for a keypress or mouse click. Both are very handy and useful, especially to beginners. And since the Amiga is multi-tasking WAIT does not use any CPU time. AmigaCOMAL also gives you a protected input field, like that in professional software. The user is restricted to where they can type in reply to an INPUT request. Full access to subdirectories is also included, similar to DOS.

A **Compiler** is available as a low cost option. It allows you to turn a COMAL program into a stand-alone file that can be run on any Amiga without the need of COMAL. This allows you to distribute your programs to any Amiga user, not just those who own COMAL.

AmigaCOMAL has its own preferences file that lets you set up how much memory to allocate to the COMAL system (up to your full installed memory) and the way the windows come up. You have a Command Window and an Execute Window. They can be on separate screens, on the workbench, or even combined into one screen (like other COMALs with one screen).

You can PASS commands to AmigaDOS or open a new CLI window from inside COMAL. Plus, all the Intuition, Exec, DOS, etc., routines are available to you, complete with all the structures pre-defined. Advanced programmers also have commands to Allocate and Deallocate data areas. **TRACE** with a Single Step mode is available to help in program debugging. And the Error Handler also includes a **RETRY** command, that allows the trapped statements to be executed over again.

There are three types of integer types (to be compatible with C structures). You can assign a value to every element in an array with one command. For example: READ table() will read values from DATA statements into the array named **table**. Or give every element that same value like this: item$():="not assigned". You also can automatically determine the top and bottom indices to any array with the commands MAXINDEX and MININDEX.

AmigaCOMAL is not copy-protected. You are encouraged to make a backup copy for yourself. However, you are not permitted to give out copies to others. (See page 26 for speed comparisons.) ■

IBM PC, MS-DOS and PS/2

UniComal IBM PC COMAL 2.2 runs under MS-DOS version 2.0 or higher on machines with at least 256k of memory. It allows 64k for program storage and another 64k for variables. It supports systems with the math coprocessor. It's price just dropped to only $165 including a compiler (previously it was about $800). It comes with an extensive reference manual packaged in the standard IBM PC style mini-binder. It also includes a spiral bound tutorial manual and many demo programs on the disks (you must specify either 5¼ or 3½ disks). School licenses available too.

It is a full Common COMAL (except output location specification) plus much more. It has time and date functions and supports sub-directories with commands such as **CHDIR** and **MKDIR**. It also gives the option of passing commands directly to MS-DOS. The error handler adds **RETRY** to allow a second chance for many operations.

It includes Hercules support in addition to the standard Graphics, Sound and System packages. The graphics package supports turtle graphics and CGA, EGA or VGA graphics screens. The system package has commands for defining the function keys, setting textwindows, converting numbers to hexadecimal or binary format, converting strings to all upper case or all lower case, and more. Other packages are available as added cost options including UniDump (support for Laser Jet / Think Jet), UniMouse, UniNet and UniMatrix.

We use UniComal IBM PC COMAL 2.2 here to run our 3000 line COMAL program to handle the order processing. We enjoy the built in text screen windowing. It makes it easy to pop up help menus. The protected input fields give us a professional feeling system. Plus it has the full screen input that we were used to with Commodore COMAL. (If you are used to C64 COMAL, you will feel right at home with IBM PC COMAL).

Every time you enter a program line, COMAL checks it for correct syntax. If it is OK, it is immediately and properly relisted. Keywords are capitalized, = is converted to :=, **THEN** and **DO** are added as needed, and so on. While in AUTO mode, COMAL starts each new line with the cursor at the proper indentation level. If an error is found in any line you enter, COMAL does not accept it and immediately informs you of the problem by placing the cursor on the point of error and printing an informative message beneath the line. Once you correct the mistake, the error message is removed from the screen and anything it overwrote is replaced (it is a non-destructive error message).

You have full control over the function keys, normal plus Shift, Ctrl, and Alt, totalling 40 keys in all. Plus you may have different definitions in edit mode and while a program is running. Yes, 80 possible keys! Thus, when a program ends, any changes it made to function keys will not affect the way they are set up for direct mode commands. There also is an option to display a small one line menu of the keys on the bottom line of the screen. This line will change as you press Ctrl, Alt or Shift to adjust the values of the function keys for that condition («shift»+«F1» is different than just «F1» so the display changes to reflect this).

Since this IBM PC COMAL is much more accurate than other COMALs (double precision) it includes a DIGITS command that can be used to set what level of precision you wish to have.

Full control of subdirectories is included, comparable to their DOS counter parts. Every element in an array can be set to a specified value with one command. The top and bottom limits of an array can also be determined using MAXINDEX and MININDEX.

The compiler included with the package allows you to convert any COMAL program into a stand-alone file that can be run directly from DOS without needing COMAL. This allows you to distribute your COMAL programs to any PC user, not just those who own COMAL.

UniComal also has an Object Oriented Programming version of their COMAL that was just released. COMAL 3.0 is available for IBM PC and PS/2 and has an OS/2 support option. The price is more than double that of COMAL 2.2. **Both version 2.2 and 3.0 are current and supported.**

COMAL 3.0 adds many new features including POINTERs and a RECORD structure. Packages are replaced by modules and can be written in COMAL, C or Assembler. Another major advance is that programs can be over 64K long, up to the limit of installed memory. However, in order to add these features, some other things were changed. Scope now is static rather than dynamic. Statements cannot be issued in direct mode (so turtle graphics cannot be interactive anymore). Thus it appears that this version is aimed specifically at professional programmers. **Version 2.2 is also good for professionals, but is great for home programmers and schools too.**

Until AmigaCOMAL was released, IBM PC COMAL was the most extensive and fastest COMAL available. Now it's a close contest between the two. You'll be pleased with either! See the benchmark results on page 26. ■

CP/M

CP/M COMAL 2.10 runs under CP/M version 2.2 or higher. We tested it on a Commodore C128, Epson, and Kaypro. It is a complete Common COMAL, and has several enhancements as well.

In addition to the usual full screen editor, you can insert a line between two other lines, delete the current line, or erase a line from the cursor position to the end of the line. An INSTALL program on the COMAL system disk lets you assign the keys to do these things if your computer does not already have keys defined for these tasks.

Two important commands included in CP/M COMAL are **TRACE** and **SYMBOLS**. **TRACE** allows you to single step through a program. As each line is executed, it is listed to a user defined device along with a dump of all intermediate calculations. **SYMBOLS** prints the names of all active variables and their current type.

CP/M COMAL allows more than one program to be in memory at a time. They can't call each other or share variables, but the EXTERNAL section makes an ideal scratch pad. Just type the command: **EXTERNAL**, press «return», and you are in a new program area. To get back again, type the command: **MAIN**.

CP/M COMAL allows the programmer access to the machine at several levels. There are commands to store or retrieve a value directly from each of the CP/M registers. You also may **CALL** a machine language routine starting at any address. In addition, you may include in-line machine code to execute short, relocatable routines. Advanced applications should use packages, which support parameter passing with procedures and functions called by name.

There also is a special graphics package for C128 computers running under CP/M. Everyone should be able to use the package. A DOC file is included on the disk for added information.

A Run Time compiler is a low cost option that takes a CP/M COMAL program and produces a **.COM** file which can be executed directly from CP/M mode. You can give the compiled program to anyone, not just COMAL owners.

A CP/M COMAL demo system is available. It includes all the features of the full COMAL system except SAVE, ENTER, and MERGE. You can load a COMAL program, list and alter it, or type in your own programs. You can list your programs to disk or printer for use in word processors and newsletters. But you can't retrieve them since the ENTER and MERGE commands are disabled. Try before you buy. ■

COMMODORE 128

The C128 COMAL cartridge is a full Common COMAL, with some very nice extra features. It includes all the commands of C64 COMAL (see page 22). It can run in fast or slow mode. You have full access to the 1571 disk drive features, but the RAM expanders (ie, 1750) do not appear to be directly supported. You can use either the 40 or 80 column screen with text windows for program editing and execution. You have 40K free memory for program and variable storage (there is only 30K free with the C64 cartridge).

An additional 40K is available for use with special RAM files. These RAM files give you direct access to any place within the file at lightning speeds, but not with the normal **READ FILE** and **WRITE FILE** commands (like with RAM drives). Instead, you must use special RAM file package commands. This is unfortunate for several reasons. No current COMAL programs can use RAM files in place of disk files to increase speed. And programs which use RAM files on the C128 will not run under any other version of COMAL.

Many package commands have been added to C128 COMAL, such as commands to peek and poke the VDC registers, to choose the 40 or 80 column screen for output, and to change the CPU speed. **GET$** from an RS-232 file has been fixed to prevent an infinite wait. A nice new command allows the user to define the ASCII character translations for files opened with the **/a+** attribute.

While the user defined packages for C128 COMAL are similar to those for C64 COMAL, they are stored in a different section of memory. Thus you cannot use C64 packages with C128 COMAL.

We import the C128 COMAL cartridge from Commodore Denmark, but don't have the staff to fully support it at this time. However, if you are interested in programming, the C128 COMAL cartridge offers a fantastic array of features and may be a good choice. But, it is not the only choice you have. There are 4 different COMALs that will run on the C128. You might also consider the CP/M mode COMAL 2.10 with its RUNTIME system, or the popular C64 COMAL cartridge with Super Chip (the chip adds C128 specific features).

Note: the C128 COMAL cartridge uses three 32K EPROMs and seems to be a heavy power drain on the C128. The power supply is a weak link for Commodore computers. It is a special order item!■

PET COMAL - Yes, we even have COMAL 0.14 for the Commodore PET 32K computer! This disk loaded system is a subset of Common COMAL and does not leave much free memory. ■

System Dependent Variations

Any programmer who has worked on more than one computer system will tell you about subtle differences among them. As standard as COMAL is, it also must deal with system variations. **Anyone programming on one computer for personal use does not have to worry about this.** However, those who use several systems should make a point of learning the differences. For example, graphics were omitted from the COMAL standard because of the incompatibility of the screen and color resolution on various computers. **However, there is a common set of graphics/turtle keywords (see page 18).**

One difference comes with devices and filenames. COMAL usually supports the naming conventions of the specific computer system. Commodore filenames can contain as many as 16 characters, while IBM and CP/M names are restricted to eight characters plus a three character extension. IBM and Amiga also support subdirectories and time/date stamping of files. Commodore disk drive names use numbers; CP/M and IBM use letters; Amiga uses words such as DF0:. All COMALs call the screen and printer DS: and LP:, except IBM, which uses the name CON: for the screen and several names for the printers.

Another difference concerns data storage. Most computers can use 5¼ or 3½ inch disks, yet each computer has its own method of storing information on that disk. Thus an IBM PC cannot read a disk written on a Commodore 1541 drive. However, this is not the only problem. There are ways to transfer data between different computer systems (including modem transfers). But even if the computers can share data, there still is one more factor to consider.

Different methods are used to represent data and programs. The user never needs to understand this, that is one of COMAL's jobs. What is important to the user is knowing that COMAL has two methods for storing programs and data on disk. One uses compact files for quick access. **WRITE FILE** and **SAVE** create these efficient files. They can only be understood by the version of COMAL that wrote them. COMAL also supports ASCII text files which can be read by most computer software including the other versions of COMAL. **LIST**, **DISPLAY**, and **PRINT FILE** produce ASCII files.

A debate has been going on for years concerning the null string and the **IN** operator. For example, what should `"" IN "abc"` return? The COMAL standard originally stated that the result was to be **TRUE** (true has a value of 1). A slight enhancement on this theme returns the length of the second string plus one. This value is accepted as true, and it allows a program to differentiate between the null string and a string matching the first character in the second string. Now, Common COMAL specifies that the null string is **not** part of any string. Thus `"" IN "text"` will always be FALSE.

A similar situation involves KEY$. What should it return if no key is pressed? Power Driver and C64 COMAL cartridge return CHR$(0); other COMALs return "" (null string).

Another situation involves **PRINT**ing several items on one line. There are 3 common ways to do this:

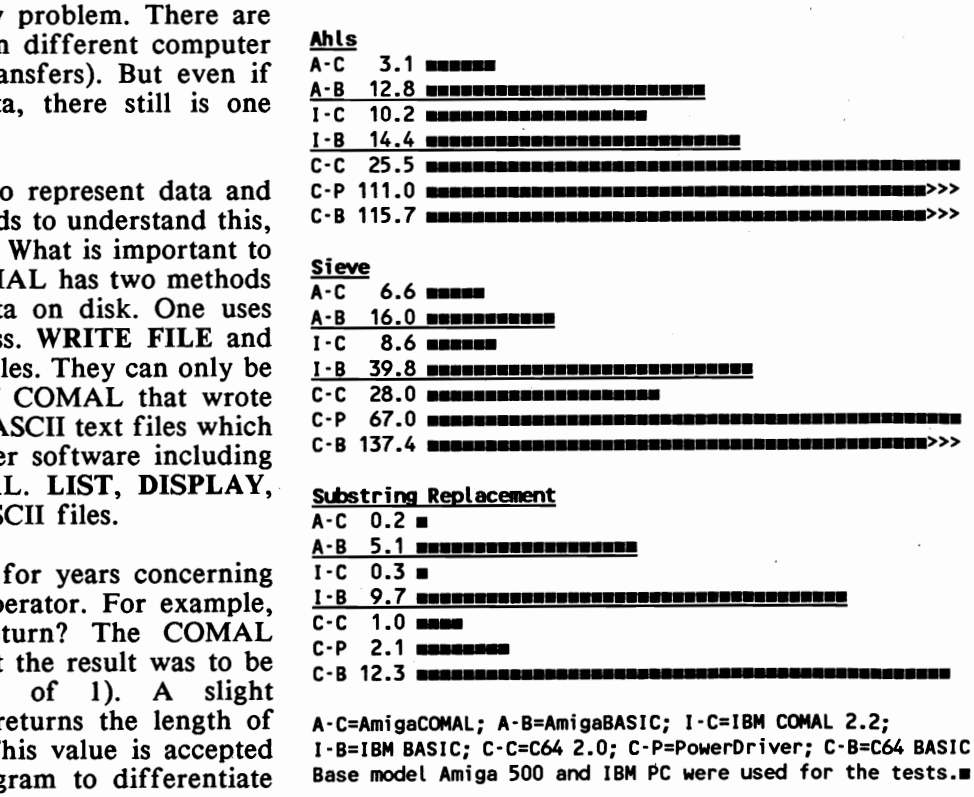
- with no space between the items
- with one space between items
- using a preset tab zone system

If you do not use the ZONE statement to set up your own tab zone intervals all COMALs will be identical: a comma (,) gives no space between items and a semicolon (;) gives one space.

However, the tab character has changed from the comma to the semicolon, and the default zone changed to match. IBM and AmigaCOMAL use the new standard. CP/M and Commodore COMALs use the original method. ■

BENCHMARK TIMINGS

Here are some benchmark run times from page 21 converted into bar charts.



A-C=AmigaCOMAL; A-B=AmigaBASIC; I-C=IBM COMAL 2.2;
I-B=IBM BASIC; C-C=C64 2.0; C-P=PowerDriver; C-B=C64 BASIC
Base model Amiga 500 and IBM PC were used for the tests.■

COMAL LOOPS

```
REPEAT
  «statement block»
UNTIL «condition»
```

```
REPEAT
  INPUT "Are you done?":reply$
UNTIL reply$ IN "YyNn"
```

```
REPEAT
  solve'problem
UNTIL errors>3
```

```
WHILE «condition» DO
  «statement block»
ENDWHILE
```

```
WHILE NOT EOF(2) DO
  READ FILE 2: text$
  PRINT text$
ENDWHILE
```

```
WHILE KEY$="" DO
  flash(prompt$)
ENDWHILE
```

```
LOOP
  «statement block»
  EXIT [WHEN «condition»]
  «statement block»
ENDLOOP
```

```
LOOP
  INPUT "Score (0=done)?":score
  EXIT WHEN score=0
  WRITE FILE 2: score
ENDLOOP
```

```
LOOP
  TRAP
    INPUT "Age: ": age
    EXIT // numeric entry OK
  HANDLER
    PRINT "Numbers only"
  ENDTRAP
ENDLOOP
```

```
FOR «var»:=«start» TO «end» DO
  «statement block»
ENDFOR «var»
```
(STEP «amount» is an option)

```
FOR month:=1 TO 12 DO
  PRINT month'name$(month);
ENDFOR month
```

```
FOR x:=-1 TO 1 DO
  READ sign$(x)
ENDFOR x
DATA "neg","zero","pos"
```

COMAL DECISIONS

```
CASE «selector» OF
WHEN «choice list»
  «statement block»
{WHEN «choice list»
  «statement block»}
[OTHERWISE
  «statement block»]
ENDCASE
```

```
CASE reply$ OF
WHEN "a","A" // add
  add'member
WHEN "d","D" // delete
  delete'member
WHEN "l","L" // list
  list'member
OTHERWISE // invalid choice
  PRINT "I can't do that."
ENDCASE
```

```
CASE eaten OF
WHEN 0
  PRINT "You might starve"
WHEN 1,2
  PRINT "Not bad"
WHEN 3
  PRINT "Great, I ate 3 too"
OTHERWISE
  PRINT "I won't pay the bill"
ENDCASE
```

```
IF «condition» THEN
  «statement block»
{ELIF «condition» THEN
  «statement block»}
[ELSE
  «statement block»]
ENDIF
```

```
IF letter$ IN vowel$
  PRINT "It is a vowel"
ELIF letter$ IN consonant$
  PRINT "It is a consonant"
ELSE
  PRINT "It is not a letter"
ENDIF
```

```
IF subscriber THEN
  PRINT "Subscriber discount";
  price:-2 // subtract 2 dollars
ELSE
  PRINT "Normal order";
ENDIF
PRINT USING "$##.##": price
```

COMAL ERROR HANDLER

```
TRAP
  «statement block»
  {REPORT}
HANDLER
  «statement block»
  {REPORT, ERR, ERRTEXT$}
  {extensions: RETRY, ERRFILE}
ENDTRAP
```

```
TRAP
  average:=score DIV number
HANDLER
  PRINT err;errtext$
  PRINT "Error in calculations"
  PRINT "We'll assume 0 as AVG"
  average=0
ENDTRAP
```

```
TRAP
  INPUT "Enter age: ":age
  IF age<0 OR age>110 REPORT 888
HANDLER
  IF err=888 THEN
    PRINT "Be reasonable."
  ELSE
    PRINT "Input error. Try again."
  ENDIF
ENDTRAP
```

PROCEDURES and FUNCTIONS

```
PROC «name»(«parameters») CLOSED
  {IMPORT «var list»}
  «block»
  {RETURN}
ENDPROC «name»
```

```
PROC continue
  PRINT "Press C to continue"
  REPEAT // empty repeat loop
  UNTIL INKEY$ IN "Cc"
ENDPROC continue
FUNC even(num) CLOSED
  IF num MOD 2 THEN
    RETURN FALSE
  ELSE
    RETURN TRUE
  ENDIF
ENDFUNC even
```

```
PROC slow'print(text$)
  FOR x:=1 TO LEN(text$) DO
    PRINT text$(x:x), //one char
    FOR slow:=1 to 99 DO NULL
  ENDFOR x
ENDPROC slow'print

FUNC just'last$(text$) CLOSED
  IF text$="" THEN RETURN ""
  max=LEN(text$)
  RETURN text$(max:max) //one char
ENDFUNC just'last$ ■
```

```
FUNC «name» («parameters») CLOSED
  {IMPORT «var list»}
  «block»
  {RETURN «value»}
ENDFUNC «name»
```

COMMON COMAL -- COMPATIBLE KEYWORDS

keyword	c64	128	ibm	cpm	ami	pow
// (comment)	■	■	■	■	■	■
abs	■	■	■	■	■	■
and	■	■	■	■	■	■
append	■	■	■	■	■	■
at	■	■	■	■	■	■
atn	■	■	■	■	■	■
auto	■	■	■	■	■	+
bitand	■	■	■	■	■	■
bitor	■	■	■	■	■	■
bitxor	■	■	■	■	■	■
bye	?	?	■	■	■	■
case	■	■	■	■	■	■
cat / dir	■	■	■	■	■	■
chain	■	■	■	■	■	■
change	■	■	■	■	■	-
chr$	■	■	■	■	■	■
close	■	■	■	■	■	■
closed	■	■	■	■	■	■
con	■	■	■	■	■	■
cos	■	■	■	■	■	■
create	■	■	■	■	■	-
curcol	#	#	■	■	■	■
currow	#	#	■	■	■	■
cursor	■	■	■	■	■	■
data	■	■	■	■	■	■
del	■	■	■	■	■	+
delete	■	■	■	■	■	■
dim	■	■	■	■	■	■
dir / cat	■	■	■	■	■	■
discard	■	■	■	■	■	-
display	■	■	■	?	■	-
div	■	■	■	■	■	■
do	■	■	■	■	■	■
elif	■	■	■	■	■	■
else	■	■	■	■	■	■
end	■	■	■	■	■	+
endcase	■	■	■	■	■	■
endfor / next	■	■	■	■	■	■
endfunc	■	■	■	■	■	■
endif	■	■	■	■	■	■
endloop	■	■	■	■	■	-
endproc	■	■	■	■	■	■
endtrap	■	■	■	■	■	-
endwhile	■	■	■	■	■	■
enter	■	■	■	■	■	?

keyword	c64	128	ibm	cpm	ami	pow
eod	■	■	■	■	■	■
eof	■	■	■	■	■	■
err	■	■	■	■	■	-
errtext$	■	■	■	■	■	-
esc	■	■	■	■	■	■
exec	■	■	■	■	■	■
exit	■	■	■	■	■	-
exp	■	■	■	■	■	■
external	■	■	■	■	■	-
false	■	■	■	■	■	■
file	■	■	■	■	■	■
find	■	■	■	■	■	-
for	■	■	■	■	■	■
free	#	#	#	■	■	■
func	■	■	■	■	■	+
get$	■	■	■	■	■	■
goto	■	■	■	■	■	■
handler	■	■	■	■	■	-
if	■	■	■	■	■	■
import	■	■	■	■	■	-
in	■	■	■	■	■	■
inkey$	■	■	■	-	■	■
input	■	■	■	■	■	■
int	■	■	■	■	■	■
key$	■	■	■	■	■	■
label	■	■	■	■	■	■
len	■	■	■	■	■	■
let (assign)	■	■	■	■	■	■
link	■	■	■	■	?	-
list	■	■	■	?	■	+
load	■	■	■	■	■	■
log	■	■	■	■	■	■
loop	■	■	■	■	■	-
main	■	■	■	■	■	-
merge	■	■	■	■	■	-
mod	■	■	■	■	■	■
new	■	■	■	■	■	■
next / endfor	■	■	■	■	■	■
not	■	■	■	■	■	■
null	■	■	■	■	■	■
of	■	■	■	■	■	■
open	■	■	■	■	■	■
or	■	■	■	■	■	■
ord	■	■	■	■	■	■
otherwise	■	■	■	■	■	■

keyword	c64	128	ibm	cpm	ami	pow
page	■	■	■	■	■	■
pass	■	■	■	-	■	-
pi	■	■	■	■	■	■
print	■	■	■	■	■	■
proc	■	■	■	■	■	■
random	■	■	■	■	■	■
randomize	■	■	■	■	■	■
read	■	■	■	■	■	■
ref	■	■	■	■	■	■
rename	■	■	■	■	■	-
renum	■	■	■	■	■	■
repeat	■	■	■	■	■	■
report	■	■	■	■	■	-
restore	■	■	■	■	■	+
return	■	■	■	■	■	+
rnd	■	■	■	■	■	■
run	■	■	■	■	■	+
save	■	■	■	■	■	■
scan	■	■	■	■	■	■
select output	■	■	?	■	■	+
sgn	■	■	■	■	■	■
sin	■	■	■	■	■	■
size	■	■	■	■	■	■
spc$	■	■	■	■	■	■
sqr	■	■	■	■	■	■
step	■	■	■	■	■	■
stop	■	■	■	■	■	+
str$	■	■	■	■	■	■
tab	■	■	■	?	■	■
tan	■	■	■	■	■	■
then	■	■	■	■	■	■
to	■	■	■	■	■	■
trap	■	■	■	■	■	+
trap esc	■	■	■	■	■	■
true	■	■	■	■	■	■
unit$ (chdir)	■	■	■	■	■	?
until	■	■	■	■	■	■
use	■	■	■	?	■	-
using	■	■	■	■	■	■
val	■	■	■	■	■	■
when	■	■	■	■	■	■
while	■	■	■	■	■	■
write	■	■	■	■	■	■
zone	?	?	■	?	■	?

c64 = C64 COMAL 2.0 cart
128 = C128 COMAL 2.0 cart
ibm = IBM PC COMAL 2.2

cpm = CP/M COMAL 2.1
ami = AmigaCOMAL
pow = Power Driver for C64

■ = fully implemented
= implemented in a package
+ = partially implemented
? = syntax/other difference
- = not implemented

COMMON COMAL -- Keyword Syntax and Examples

// : allows comments in a program
// anything typed here

ABS : gives the absolute value
ABS(«numeric expression»)
PRINT ABS(standard'number)

AND : logical AND
«expression» AND «expression»
IF number>0 AND number<100 THEN

APPEND : start at end of file for writing
OPEN [FILE] «file#»,«filename»,APPEND
OPEN FILE 2,"test.dat",APPEND

AT : begin at specified location
PRINT AT «row»,«col»: [«print list»[«mark»]]
INPUT AT «row»,«col»[,«len»]: [«prompt»:] «var list»[«mark»]
PRINT AT 1,1: "Section number:"; num;
PRINT AT 0,8: USING "$##.##": amount
INPUT AT 0,9: "?": reply$;//0=stay on same row
INPUT AT 5,0: "": address$//0=stay in same col

ATN : arc tangent
ATN(«numeric expression»)
PRINT ATN(num1+num2)

AUTO : automatic line numbering
AUTO [«start line»][,«increment»]
AUTO 9000
AUTO
AUTO 531,1

BITAND : bitwise AND
«argument» BITAND «argument»
show(bnum BITAND %00001000)

BITOR : bitwise OR
«argument» BITOR «argument»
PRINT (bnum BITOR flag)

BITXOR : bitwise XOR
«argument» BITXOR «argument»
bnum=(num1+num2) BITXOR %10000000

BYE : exit COMAL (C64, C128 use BASIC)
BYE

CASE : multiple choice decisions
CASE «control expression» [OF]
CASE reply$ OF
CASE choice OF

CAT : gives disk directory, see also DIR
CAT [«filename»]
CAT

CHAIN : load & run program on disk
CHAIN «filename»
CHAIN "menu"

CHANGE : change text
CHANGE "«old text»","«new text»"
CHANGE "zz","print'report"

CHR$: gives the character specified
CHR$(«numeric expression»)
PRINT CHR$(num)

CLOSE : closes files
CLOSE [[FILE] «filenum»]
CLOSE FILE 2
CLOSE

CLOSED : all proc/func variables local
PROC «procname»[(params)] [CLOSED]
FUNC «funcname»[(params)] [CLOSED]
PROC newpage(header$) CLOSED
FUNC gcd(n1,n2) CLOSED

CON : continue program execution after STOP
CON

COS : cosine
COS(«numeric expression»)
PRINT COS(number)

CREATE : create RANDOM file on disk
CREATE «filename»,«# records»,«record size»
CREATE "names",128,300

CURCOL : returns the cursor column position
CURCOL
column:=CURCOL

CURROW : returns the cursor row position
CURROW
row:=CURROW

CURSOR : positions the cursor
CURSOR «row»,«column»
CURSOR 0,1 // 0=stay in same row

DATA : provides data for a READ
DATA «value»{,«value»}
DATA "Sam",134,"Fred",22,"Gloria",46

DEL : deletes lines
DEL «range»
DEL 460-530
DEL pause

DELETE : deletes a file from disk
DELETE «filename»
DELETE "test5.dat"

DIM : reserve string/numeric array space
DIM «string var» OF «max char»
DIM «str array»(«index») OF «max char»
DIM «array name»(«index»)
DIM name$ of 30
DIM players$(1:4) OF 10
DIM scores(min:max), table(10,2)

DIR : display directory of disk, see CAT
DIR [«filename»]
DIR

DISCARD : discards packages
DISCARD

DISPLAY :display program without line numbers
DISPLAY [«range»] [TO] [«filename»]
DISPLAY "names.dsp"
DISPLAY init

DIV : division with integer answer
«dividend» DIV «divisor»
result=guess DIV count

ELIF : starts an "else if" condition
ELIF «expression» [THEN]
ELIF reply$ IN "YyNn" THEN

ELSE : alternative in IF structure
ELSE

END : halt program (& show message)
END [«message»]
END "All Done."

ENDCASE : end of CASE structure
ENDCASE

ENDFOR : end of FOR structure
ENDFOR [«control variable»]
ENDFOR sides

ENDFUNC : end of function
ENDFUNC [«function name»]
ENDFUNC even

ENDIF : end of IF structure
ENDIF

ENDLOOP : end of LOOP structure
ENDLOOP

ENDPROC : end of procedure
ENDPROC [«procedure name»]
ENDPROC show'item

ENDTRAP : end of TRAP structure
ENDTRAP

ENDWHILE : end of WHILE structure
ENDWHILE

ENTER : retrieve ASCII program lines
ENTER «filename»
ENTER "test5.lst"

EOD : End Of Data flag
EOD
WHILE NOT EOD DO

EOF : End Of File flag
EOF(«filenum»)
WHILE NOT EOF(infile) DO

ERR : returns current error number
ERR
CASE err OF

ERRTEXT$: returns error message
ERRTEXT$
PRINT ERRTEXT$

ESC : escape key pressed flag
ESC
EXIT WHEN ESC

EXEC : execute a procedure
[EXEC]«procname»[(«parameter»,{«parameter»})]
show'item(number)

EXIT : exit the LOOP structure
EXIT [WHEN «condition»]
EXIT WHEN errors>3

EXP : natural log e to n
EXP(«numeric expression»)
PRINT EXP(number)

EXTERNAL : external proc/func
PROC «name»[(«parms»)][EXTERNAL «file»]
FUNC «name»[(«parms»)][EXTERNAL «file»]
FUNC rec'size(name$) EXTERNAL "rec.ext"
PROC instructions EXTERNAL "instruct.ext"

FALSE : predefined value equal to 0
FALSE
ok:=FALSE

FIND : finds text in a program
FIND "«text string»"
FIND " PROC "

FOR : start of FOR loop structure
FOR «var»:=«start» TO «end» [STEP «#»] DO [«statement»]
FOR x:=10 TO 1 STEP -1 DO PRINT x

FREE : returns amount of free program memory
FREE
PRINT FREE

FUNC : start of a multi-line function
FUNC «name»[(«parm»)] [CLOSED]
FUNC «name»[(«parm»)] EXTERNAL «filename»
FUNC call'answered(msg$)
FUNC file'exists(name$) CLOSED

GET$: returns # of characters from open file
GET$(«filenum»,«# of characters»)
text$=GET$(2,16)

GOTO : go to line after specified label
GOTO «label name»
GOTO jail

HANDLER : lines executed if error occurs
HANDLER

IF : start of conditional IF structure
IF «condition» THEN [«statement»]
IF reply$ IN "yYnN" THEN

IMPORT : import into CLOSED proc/func
IMPORT «identifier» {,«identifier»}
IMPORT running'total

IN : locate string1 within string2
«string1» IN «string2»
IF guess$ IN word$ THEN winner

INKEY$: wait and return the key pressed
INKEY$
reply$=INKEY$

INPUT : input from keyboard or file
INPUT FILE «file#»[,«rec#»]: «var list»
INPUT [AT «row»,«col»[,«len»]:] [«prompt»:] «var list»
INPUT FILE 2: text$
INPUT AT 5,2,10: "Zip Code: ": zip'code,
INPUT "Enter age---> ": age

INT : nearest integer (less than or equal)
INT(«numeric expression»)
tally:+INT(number)

KEY$: scans keyboard & returns key typed
KEY$
UNTIL KEY$="c"

LABEL : assign label name to the line
[LABEL] «label name»:
months:

LEN : gives the length of a string
LEN(«string expression»)
length=LEN(text$)

LINK : loads a package from disk
LINK «filename»
LINK "mouse"

LIST : list program lines
LIST [«range»] [TO] [«filename»]
LIST header
LIST pause "pause.lst"
LIST "myprog.lst"

LOAD : load a program from disk
LOAD «filename»
LOAD "menu"

LOG : natural logarithm of n
LOG(«numeric expression»)
PRINT LOG(number);

LOOP : start of LOOP structure
LOOP

MAIN : leave external to main program
MAIN

MERGE : merge program lines from disk file
MERGE [«line#»[,«increment»]] «filename»
MERGE "readrec.lst"
MERGE 831,1 "setflags.lst"

MOD : remainder of division (modula)
«dividend» MOD «divisor»
color=number mod 16

NEW : clears program from memory
NEW

NEXT : converted to ENDFOR, see ENDFOR

NOT : logical NOT
NOT «condition»
IF NOT ok THEN

NULL : does nothing
NULL

OPEN : open a file
OPEN [FILE] «file#»,«filename»,«type»
OPEN FILE 2,"scores.dat",READ
OPEN FILE 7,"subs.ran",RANDOM 88

OR : logical OR
«condition» OR «condition»
IF reply$<"a" OR reply$>"z" THEN

ORD : ASCII (ordinal) value of character
ORD(«string expression»)
a=ORD("a")

OTHERWISE : default for CASE
OTHERWISE

PAGE : clearscreen / formfeed
PAGE

PASS : pass a command to operating system
PASS «operating system command»
PASS "dir"

PI : value of pi
PI
PRINT "Value of PI is";PI

PRINT : print items to screen/printer/file
PRINT [AT «row»,«col»:] [USING «format»:] «list»
PRINT [FILE «#»[,«rec»]:] [USING «format»:] «list»
PRINT FILE 2: text$
PRINT AT 9,1: USING "$###.##": money
PRINT "The winner is";winner$

PROC : start of multi-line procedure
PROC «name»[(«parm»)] [CLOSED]
PROC «name»[(«parm»)] [EXTERNAL «file»]
PROC readrec(number)
PROC convert(REF text$) CLOSED

RANDOM : random access disk file
OPEN FILE «file#»,«filename»,RANDOM «len»
OPEN FILE 2,"subs",RANDOM 88

RANDOMIZE : seeds random number generator
RANDOMIZE [«seed»]
RANDOMIZE

READ : read data from DATA line or file
READ [FILE «file#»[,«rec#»]:] «var list»
OPEN [FILE] «filenum»,«filename»,READ
READ name$,age
READ FILE 2,record: name$,adr$,city$,st$
OPEN FILE 3,infile$,READ

REF : parm var used in reference (alias)
REF «var»
PROC alter(REF text$) CLOSED

RENAME : rename a disk file
RENAME «old filename»,«new filename»
RENAME "temp","final"

RENUM : renumber program
RENUM [«target start»][,«increment»]
RENUM 9000,1

REPEAT : start of REPEAT structure
REPEAT

REPORT : part of ERROR HANDLER
REPORT [«error code»]
REPORT 99

RESTORE : reuse DATA with READ
RESTORE [«label»]
RESTORE month'names

RETURN : returns value of a function
RETURN [«value»]
RETURN TRUE
RETURN text$

RND : random number
RND [(«start num»,«end num»)]
dice=RND(1,6)+RND(1,6)

RUN : run program in memory or on disk
RUN [«filename»]
RUN "DMC"

SAVE : store program to disk
SAVE «filename»
SAVE "thewhale"

SCAN : scan for correct structures
SCAN

SELECT : choose output location
SELECT [OUTPUT] «type»
SELECT OUTPUT "lp:" // line printer
SELECT OUTPUT "ds:" // data screen

SGN : -1 if neg, 0 if 0, 1 if pos
SGN(«numeric expression»)
flag=SGN(number)

SIN : gives sine
SIN(«numeric expression»)
plot(SIN(num),y)

SIZE : report on free memory
SIZE

SPC$: returns # of spaces specified
SPC$(«number of spaces»)
PRINT SPC$(39)

SQR : gives square root
SQR(«numeric expression»)
root=SQR(number)

STEP : increment FOR loop by this amount
FOR «var»:=«start» TO «end» STEP «increment» [DO]
FOR x=1 TO max STEP 2 DO

STOP : halt program execution
STOP [«message»]
STOP "now inside PROC remove'blank"

STR$: converts number into string
STR$(«number»)
zip$=STR$(number)

TAB : move cursor to specified column
TAB(«column number»)
PRINT TAB(col), name$

TAN : gives tangent
TAN(«numeric expression»)
PRINT TAN(number)

THEN : part of IF structure. See IF and ELIF

TO : part of FOR structure
FOR «var»:=«start» TO «end» [STEP «increment»] [DO]
FOR x:=1 TO 4 DO

TRAP : catch errors in running program
TRAP

TRAP ESC : disable/enable break key
TRAP ESC +|-
TRAP ESC- //disable break keys
TRAP ESC+ //enable break keys

TRUE : predefined value of 1 or NOT FALSE
TRUE
RETURN TRUE

UNIT : sets the default unit
UNIT «string expression»
UNIT data'drive$

UNIT$: returns the current unit
UNIT$
PRINT UNIT$

UNTIL : end of REPEAT loop
UNTIL «condition»
UNTIL reply$="q"

USE : use specified package
USE «package name»
USE system

USING : formatted output
PRINT USING «format»: «var list»
PRINT USING "##> $###.##": x; cash(x)

VAL : returns numeric value of string
VAL(«numeric string»)
age=VAL(reply$)

WHEN :choice in CASE structure. See also EXIT
WHEN «list of values»
WHEN "Jan","jan"
WHEN 1,2

WHILE : start of WHILE structure
WHILE «expression» [DO] [«statement»]
WHILE NOT EOF(infile) DO process

WRITE : write to a file
WRITE FILE «file#»[,«rec#»]:«var»
OPEN [FILE] «filenum»,«filename»,WRITE
WRITE FILE 2: name$
WRITE FILE 4,rec: name$,adr$,city$,st$,zip
OPEN FILE 3,"scores",WRITE

ZONE : set tab interval/return current tab set
ZONE [«tab interval»]
ZONE 5
current'zone=ZONE ■

C64 COMAL 2.0 and 1581 Drive

Dear Len: I am finally enjoying my COMAL disks (I have about 20) since I recently purchased my first disk drive (a 1581). I passed on my chance to get a drive last year in order to purchase my COMAL 2.0 cartridge. I'll never regret that. I love COMAL 2.0! It is everything I ever wanted in a computer language. COMAL 2.0 with the 1581 disk drive is an almost unbeatable combination on my C64. They work beautifully together and the 1581 has the high density storage I need for certain database applications while COMAL 2.0 gives me the power to access the same. You can put a lot of programs on one 1581 disk! I placed 242 COMAL 0.14 files including COMAL 0.14 itself on one disk! - Randy Ragle, DeQueen, AR

Amiga, Benchmarks, 64 Emulator

Dear Len: Having tried BASIC again on an Amiga, I missed the many advantages of COMAL. I could hardly wait to demonstrate COMAL to my local Amiga club. Converting from C64 COMAL programs to AmigaCOMAL was easy. After LISTing the programs to disk, I used the Transfer Software included with ReadySoft's *The 64 Emulator 2*. This program provides the necessary conversion from PETASCII to ASCII during the transfer, and works with a 1541 or 1571 drive. - Bert Denaci, Massapequa Pk, NY

We got two other letters/disks from Bert. He ran some benchmark programs on both his Amiga 500 and Amiga 2500 (remember, he did an article on benchmark testing back in *COMAL Today #12*). He has this to say: "*It is noted that, except for the Trig test, AmigaCOMAL on the Amiga 500 is equal to or faster than AmigaBASIC on the Amiga 2500 with its Accelerator board.*" Bert also submitted his 3D airplane program (issue #13) in AmigaCOMAL. It will be on our first AmigaCOMAL programs disk.

In conclusion, Bert says, "*I am pleased to have AmigaCOMAL. It is like getting an old friend back, and now I can convert COMAL 2.0 and 0.14 programs to the Amiga.*"

Less Technical

Dear Mr. Lindsay: I have enjoyed reading your magazine and will continue to be a subscriber. I would like you to know that I am disappointed that the last couple issues were very technical. What I enjoyed most about your magazine was how you demonstarted the COMAL language. -R Daniel Gamble, Metairie, LA *[Hopefully this issue will do the trick. We try to please both those who want tons of tech talk, and the general users]* ■

COMAL Standards

by Svend Daugaard Pedersen (AmigaCOMAL developer)

I read with interest Joel Rea's article in *COMAL Today #24* about a new Multilevel COMAL standard. As the programmer of AmigaCOMAL, I certainly have some comments as well as my own idea of a new COMAL standard (COMAL90 ?).

It is necessary to include some sort of a structured data type.

First some comments. Joel has realized (along with many others) that it is necessary to include some sort of a structured data type. The idea of reusing the keyword DIM is natural, although the problem with introducing new keywords will almost be eliminated if my proposal is followed (more on that later). The virtual memory file is a nice idea. Also the AT clause in the DIM statements is useful but it cannot replace a pointer variable. The very useful data types *lists* and *trees* cannot be constructed using the AT clause.

I agree that pointer variables are awful. They pull a programming language down to a lower level (in fact quite close the machine language level). But I have not seen any replacements for them, yet.

The WITH statement would be very handy but unfortunately it will be very difficult to implement in a line oriented programming language like COMAL. I think it only would be possible at the cost of speed or the cost of the great flexibility in which COMAL handles different types.

As a COMAL, the new standard will be rather close to Amiga COMAL, as well as most other COMALs.

Now to my ideas of a new standard. You may think this must be close to my AmigaCOMAL. Of course it will. As a COMAL, the new standard will be rather close to AmigaCOMAL, as well as most other COMALs. But I think some quite new ideas have to be introduced.

Having finished the implementation of the AmigaCOMAL in which I have included structured data types, pointers and three different integer types (byte, short and long), I realized that I had went too far, although all the extensions were made in the "*spirit of COMAL*" (I discussed every extension with Borge Christensen).

The problem is that an AmigaCOMAL program using all the new things is very unpleasant to look at (and Joels new COMAL will have the same problem). All the different special characters ($,#,%,!,&,@ etc.) are not very nice to look at (*Borge once said that it looks as if the program has got measles*).

My idea is that we go back to the original COMAL80 standard from 1979. In this COMAL there are only two data types: strings and numbers (floating point). A string variable is identified by a dollar sign. But what about the integers, the structured data type and whatever else you can think of. Should we drop that! Of course not!

In fact, this is not a new idea.

A variable without a type identifier (and the dollar sign is the only one) is a floating point variable unless it has been declared to be of another type in a special statement. In fact, this is not a new idea. In the existing COMALs a "*floating point variable*" may be used as a name for a function, a procedure, an array and even a label. But it must be declared before it is used in this way.

The declaration of integer variables should be done in a DIM statement:

```
DIM alfa, beta OF LONG
DIM i, j, k OF USHORT, a, b OF BYTE
```

It is more difficult with the structured data type. First we have to declare the type:

```
RECORD person'type
    FIELD name$ OF 20
    FIELD address$ OF 30
    FIELD age OF UBYTE
ENDRECORD person'type
```

Then the variables may be declared:

```
DIM person OF person'type
DIM person'array(100) OF person'type
```

Note that I have not used the word DIM in the definition of the type. This is because it is only a definition of the inner structure of the type. No data field is created.

A function and a procedure declaration should look like:

```
FUNC euler(m,n:USHORT):USHORT CLOSED
```

and

```
PROC read'field(REF p:person'type, line)
```

The word OF could be used instead of ':' but I think the lines would grow too long. Note the parameter *line*. This is a floating point parameter since the default type for this name is float.

And now to my next idea (*please get yourself a drink if you have weak nerves!*). I think we should make COMAL case sensitive!

I think we should make COMAL case sensitive.

Why? Well, Joel has touched on the problem. New keywords might be in conflict with variable names in existing programs. But this is not the only case where you have the problem. I am sure you have tried to find a name for an output procedure. All the names you can think of are reserved: print, list, output, out, write, display. In fact it is easier to be a Dane. All reserved words are English so the Danish words are all free (*but I can assure you that this is the only advantage we Danes have in working with computers. Can you imagine the problems we have with national letters having the same ASCII codes as [\]{\}* ?).

Keywords should all be written with upper case letters. Names may be written with upper case letters as well as lower case and two names such as *Fred* and *fred* are different. In this way all the names for the output procedure listed above may be used. Another advantage is that the naming style known from Modula-2 and C (at least C on the Amiga) can be used: *PersonType* instead of *person'type*. I think it is more readable.

My intention was that all the routines should have the same names and use exactly the same parameters as the ones used in C.

I had a problem when I wrote the standard packages used to call system routines in the Amiga from AmigaCOMAL. **My intention was that all the routines should have the same names and use exactly the same parameters as the ones used in C.** Using the same parameters caused no problem but some of the names were reserved words in AmigaCOMAL (for instance Write, Close and Read). My solution was to add the prefix pck to all names so that you have to write pckopenscreen instead of OpenScreen and pckioerr instead of IoErr. With a case sensitive COMAL the more readable names could have been used.

I look forward to see the reaction to my proposals.

References:

Common COMAL - Problem Areas, Len Lindsay, *COMAL Today #24*, page 5

Common COMAL - Definition and Test Functions, *COMAL Today #24*, page 21

Proposed COMAL Multilevel Standard, Joel Rea, *COMAL Today #24*, page 47

Guest Editorial, Robert Ross, *COMAL Today #18*, page 4

COMAL Kernal, *COMAL Today #17*, page 40

How To Use The Kernal, Richard Bain, *COMAL Today #17*, page 55

COMAL Standards Meeting, Brian Grainger, *COMAL Today #15*, page 62

Scope Rules, Richard Bain, *COMAL Today #14*, page 60

COMAL Standards Conference / Graphics Kernal, *COMAL Today #7*, page 8 ■

UPDATE To CP/M COMAL KEYS

James Synnamon sends us this update:

KEY	Result
CTRL-Q	Opens up a blank line above the line that the cursor is on. The cursor moves to the start of the blank line.
CTRL-V	Pushes all characters to the right of the cursors position one space to the right, opening up a space under the cursor.
ESC	Moves the cursor to the start of the next line (not the same as hitting «Return». [AmigaCOMAL does this too]

AmigaCOMAL Features

AmigaCOMAL has all the COMAL Kernal and Common COMAL keywords and structures. In addition it has significant extensions! It is very fast (see the benchmark programs results in this issue). It is totally "Amigatized".

Plus all that, it seems to be a next generation of COMAL by expanding the language. It seems just as powerful as the new IBM PC COMAL 3.0, yet it is not nearly as complex! **Power to the people!**

A Compiler is available!

Here is just a sampling of AmigaCOMAL features:

- Fully Common COMAL compatible!
- Multi-line IF and CASE decision structures.
- Multi-line FOR, REPEAT, WHILE and LOOP loop structures, including LOOP x TIMES.
- Super flexible multi-line Error Handler structure, complete with RETRY option.
- User defined procedures and functions, with parameter passing, recursion and LOCAL variables.
- IMPORT, EXPORT and GLOBAL statement for complete flexibility with CLOSED procedures and functions.
- Test out a procedure from direct mode!
- Procedures and functions can be external to your program. A running program can execute them directly from disk.
- Store procedures and functions on disk. Merge them into future programs with the MERGE command.
- Instant syntax error help! If a program line is not correct, an error message window pops up with helpful information about what is wrong, and the cursor is placed at the point of error.
- Automatic backup of files. Original file is not overwritten if you store a new file with the same name. The original file is renamed with the extension .backup tacked onto its name.
- Protected INPUT fields. Your programs will have the professional look.
- PRINT AT and INPUT AT let you position the starting location on the screen.
- PRINT USING gives you formatting control of numeric output.
- AmigaCOMAL support section on People Link and CompuServe national networks. Includes Download Libraries, Q&A Message base, Official notices and monthly conferences.
- **Turtle Graphics are included** (Logo compatible).
- Record structures! They can be nested. A new record structure can use an existing model.
- System structures! All the structures necessary to interface directly with AmigaDOS, Exec, Intuition, etc. are predefined for you.
- Pointers are available. You can construct lists and trees using these pointers!
- ALLOCATE and DEALLOCATE for data areas.
- **Compiler is available.** Make any COMAL program a stand-alone program that can be started directly from AmigaDOS (by CLI or WorkBench Icon). The icon is created automatically for you. You may distribute your compiled programs as you wish (no royalty to pay to AmigaCOMAL authors).
- Pass parameters to a compiled COMAL program or to AmigaCOMAL itself (tooltypes from its icon in WorkBench, or the tail end of the command line in CLI).
- List all the packages currently in "use"... or list all the new commands added by any package via the LISTPACK command.
- TRACE and SINGLE STEP mode is available for program debugging.
- TIME$ and DATE$ are included as well as TIMER.
- Lines are Re-Listed immediately as you enter a program! Omitted words are inserted, keywords capitalized, = converted to :=, spacing corrected, indented to proper level, etc.
- Execute and Command Windows can be separate or combined into one Window.
- Scroll a program listing back up the screen if you just miss a line.

AmigaCOMAL Features (continued)

- **Write packages in COMAL!** Finally I can write packages myself. Packages also may be written in C, Modula2, or Assembler.
- SIGNAL is used by the system to allow any package instant access to import events occurring, such as USE, DISCARD, NEW, RUN, END, Error Abend, etc.
- Pass the "name" of a procedure or function as a parameter.
- Assign values to a whole array with one statement. Example:

```
READ table(,) //reads values from DATA statements
```

- DIM can be used with normal variables.
- Numbers can be represented in binary or hex as well as decimal.
- SELECT INPUT and SELECT OUTPUT are joined by SELECT INOUT.
- READWRITE is an added mode when opening files.
- MININDEX and MAXINDEX return the top and bottom index to an array.
- Includes Function Keys, Drop Down Menus, Mouse, and Window/Screen control.
- Has an **insert mode.**
- Insert a blank line anywhere on the screen.
- Remove a line from anywhere on the screen.
- Has Amiga Key short cuts to commands (Run, Step, Pause, Continue, Stop,...)
- Install program gives you flexibility. Interlace screen or not, hi-res or not, default font, etc.
- Amount of memory to allocate to COMAL work space is limited only by memory available.
- Memory Window can be constantly open, always showing the free memory available to COMAL.
- Directory and Subdirectory control with CHDIR or CD, MAKEDIR or MKDIR, DIR$, DIR, CAT, UNIT and UNIT$.
- Sequential and Random Access files in either ASCII or binary format.
- PASS command to open a new CLI window or to pass a command to AmigaDOS.
- WAIT command to put COMAL program in a waiting state (for a set time or until a key or mouse button is pressed). This does not tie up the CPU and is needed for proper multi-tasking.
- Three types of integer variables for compatibility with C routines.
- ROUND is built in (plus the standard INT).
- Repeat a string "function". Example:

```
PRINT 5*"a"
aaaaa.
```

- Screen and color controls.
- Messages package gives full access to this Amiga capability.
- Event handling / exceptions allow you to monitor exceptions. This allows a type of interrupt routine.
- Direct interface to Amiga libraries, such as Exec_library, Dos_library, Intuition_library, Graphics_library, Layers_library, Diskfont_library, Icon_library, Potgo_library.
- Devices package with its own predefined record structures.
- Windows and Screens packages allow you open and control your own windows or screens.
- Gfx, RastPort and View packages with predefined structures for your use.
- Three different graphics packages to choose from. Turtle has Logo compatible graphics. PCGraphics is compatible with Commodore 64 and IBM PC COMAL graphics. Graphics is the standard package.
- Speech package that makes it easy to have your Amiga talk back.

All this and more as they say.

COMALs time may finally have come. AmigaCOMAL has arrived (under $100) and IBM PC COMAL 2.2 has dropped in price from $800 to only $165 (including the compiler). Disk loaded Power Driver for the Commodore 64 is now only $9.95 and includes a 22 lesson interactive on disk tutorial. ■

Procedures - Multiple Views

by Captain COMAL

I developed this exercise to demonstrate procedures in AmigaCOMAL. However, it will apply to other COMAL 2.0 systems (even to Power Driver for much of it), except for the more advanced parts. **Only AmigaCOMAL can do the complete exercise.**

The first thing we will do is write a procedure. We will make mistakes on purpose to see the error messages. Before you start writing a new program, make sure you clear out the program area of any previous program. Type:

```
NEW
```

Next we want to start up the automatic line numbering mode. COMAL will provide the line numbers for us:

```
AUTO
```

Now just type in the procedure as follows. I will intersperse comments and suggestions. Only type one of the lines that assign rvson$ ... the one to match your computer! Do not type the leading //.

```
PROC bar(name$,max,num) CLOSED  // <<< Start a procedure
  width=80 // width output screen, C64 users set to 40
  rvson$=chr$(16);rvsoff$=chr$(16)//reverse field Amiga
  // rvson$=CHR$(18);rvsoff$=CHR$(19) // reverse on IBM
  // rvson$=CHR$(18);rvsoff$=CHR$(146)// reverse on C64
  // rvson$=CHR$(29);rvsoff$=CHR$(29) // reverse on CP/M
  PRINT name$;rvson$, // ; gives 1 space , gives no space
```

COMAL will give you immediate error messages and help.

Note: type the next line in several steps to illustrate the syntax error messages you get immediately. The specific error messages will vary between COMALs, but all will give you immediate error messages and help. I will list the messages given by AmigaCOMAL. The final correct line is shown after these intermediate lines. Remember, we are still in AUTO mode this whole time:

```
  FOR «enter»
{variable expected}
  FOR    x «enter»  <=== use lots of extra spaces
{:= expected}
  FOR    x= «enter»
{illegal type}     <=== need a number, got a blank
  FOR    x=0 «enter»
{TO expected}
  FOR    x=0to «enter»  <=== no space after 0
{illegal type}          <=== need a number again
  FOR    x=0to  num «enter»<=== use lots of extra spaces
{All COMALs except C64 will now relist the line like this:}
  FOR x:=0 TO num DO
```

Note: we are still in AUTO mode, and COMAL has prompted you with the next line number (0060). However, we forgot to put in the STEP for the FOR loop, so we need to go up and add it! All COMALs will let you cursor up and then over to one space after the word num ... then add this:

```
FOR x:=0 TO num STEP max/(width*.8) «enter»
```

All COMALs have an insert mode, so for the above addition, you could turn on insert mode and type the addition in front of the word DO, however, it is not necessary, since COMAL will add the word DO for you anyway!

Amiga users also can use the mouse to position the cursor.

Amiga users also can use the mouse to position the cursor. To add the above you could have pointed the mouse to the D in the DO, and clicked the left mouse button to put the cursor there.

After adding the STEP to the previous line, we are still in AUTO mode, so we can continue with our procedure (remember, with reverse field mode, a space is printed as a box):

```
    PRINT "▫", // print one space, note comma at end
  ENDWHILE // this is wrong, but type it anyway!
  PRINT rvsoff$, // turn printing back to normal
  PRINT USING "###.#":num
ENDPROC //don't type in the proc name, COMAL adds it later
```

Now stop AUTO mode. The way to do this varies with the computer:

STOP AUTO MODE

Amiga:	**«Esc»**
IBM:	**«Ctrl» + «Break»**
C64 2.0:	**«Run/Stop»**
Power Driver:	**«Return» on blank line**
CP/M	**«Esc»**

You should save your work now. Save your programs often. If anything should ever go wrong, you will be able to get back most of your work that way:

```
SAVE "temp"
```

Note that most COMALs (not C64) will tack on a filename extension for you. CP/M and Amiga COMALs uses .sav while IBM uses .cml.

COMAL is very helpful. It checks each line as you type it for errors. We demonstrated how it caught errors in lines entered. COMAL also can check your whole program to verify if all the structures are correct. Remember, we typed ENDWHILE to end the FOR loop. Watch COMAL catch this:

```
SCAN
```

COMAL caught the error and advises you of it:

```
ENDFOR expected (0070)
```

The line number (0070) will vary depending on how you typed in the procedure. The message will vary between COMALs, but will be similar. It is a helpful message. It is telling us that it expected to find an ENDFOR statement in line 70, but did not! Let's fix that line. But let's type NEXT instead:

```
LIST 70
0070 ENDWHILE
```

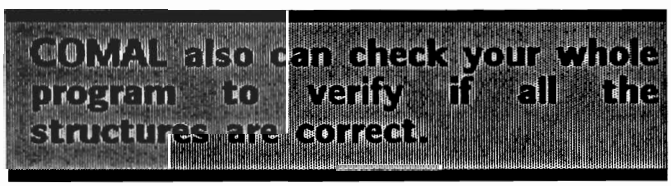
Now, cursor up and change the line to this:

```
0070 NEXT
```

As soon as you hit «enter» Amiga, IBM and CP/M COMAL will immediately re-list the line properly (including the indentation):

```
0070    ENDFOR
```

C64 note: it also changes NEXT into ENDFOR, but does not re-list the changed line.



After correcting that line, have COMAL scan it for errors again:

```
SCAN
```

The cursor returned right under SCAN, with no error messages. That means all is OK.

Now, save your work again:

```
SAVE "bar"
```

Now, take advantage of one of COMAL's features! Test out the procedure from direct mode. Type:

```
bar("test",25,5)
```

You should have a bar graph similar to this:

```
test ■■■■  5.0
```

It works! Oh, before we forget, list your procedure to see how COMAL added the procedure name after ENDPROC for you ... and added the FOR loop variable after ENDFOR too:

```
PROC bar(name$,max,num) CLOSED
  width:=80 // width output screen, C64 users set to 40
  rvson$:=chr$(16);rvsoff$:=chr$(16)//reverse field Amiga
  PRINT name$;rvson$, // ; gives 1 space , gives no space
  FOR x:=0 TO num STEP max/(width*0.8) DO
    PRINT " ", // print one space, note comma at end
  ENDFOR x
  PRINT rvsoff$, // turn printing back to normal
  PRINT USING "###.#":num
ENDPROC bar
```

Notice all the things COMAL does for you. It capitalized all the keywords and put your variable names in lower case (regardless of how you typed them). It indents lines properly. It removes extra spaces typed in a line (except those with quotes). It changed the = into := (computer science people like having the colon in front of the = when it is used for assignment). It added the word DO at the end of the FOR statement. It changed NEXT into ENDFOR and added the variable name. It added the procedure name after ENDPROC. All in all, it makes you look good (as a programmer that is).

You have already saved the procedure to disk. That is how you store programs on disk, so you can LOAD them back any time.

Now, let's prepare for the future and store the procedure in ASCII form, so it can be merged into future programs. Type:

```
LIST "bar"
```

COMAL (except C64) will tack on the .lst filename extension for you.

Power Driver note: you should renumber procedures to have line numbers over 9000 before you list them to disk, as Power Driver does not renumber lines as it merges them later. Do this:

```
RENUM 9000,1
LIST "bar"
```

While we are at it, let's store the procedure in a form that can be used as an external procedure:

```
SAVE "bar.ext"
```

Power Driver note: external is not implemented in Power Driver.

AmigaCOMAL has one more option for us ... we can turn this procedure into a package! Just add this one line:

```
0001 EXPORT bar(,,)
```

The commas inside the () indicate how many parameters are being passed. Use the same number of commas as you used when typing the PROC header statement.

Now, just save it as a package:

```
SAVE "bar.pck"
```

You just created your very own package! Applause!

Now you can erase the procedure and start the demo program:

```
NEW
```

Use AUTO mode to type in the program:

```
AUTO
page  // Clears the screen
DIM test$(1:4) OF 20 // set up a titles string array
// 1:4 means elements 1 through 4, 20 means 20 chars each
RESTORE TITLES // restore next data pointer
READ test$() // READ values for the WHOLE array at once
```

NOTE: The above line to read in values for the whole array at one time is a short cut that works with IBM and AmigaCOMAL. C64 COMAL has to read one element at a time like this:

```
FOR z=1 TO 4 DO READ test$(z)
```

Power Driver note: RESTORE does not allow you to specify the point to restore to, it always restores to the first data item. You must make sure the DATA is in the correct order, and in this program it is. Just omit the DATA 0,"junk" line below. Omit the RESTORE lines as well.

Still in AUTO mode, continue typing:

```
RESTORE AMIGA // restore next data pointer again
FOR x:=1 TO 4 DO // notice var X again, but no conflict
  PRINT ">>>>>";test$(x)
  READ comal,basic // read two numbers
  max=comal // find the largest of the two numbers
  IF basic>max THEN max=basic // is it larger?
  bar("COMAL",max,comal) // draw first bar
  bar("BASIC",max,basic) // draw second bar
  PRINT // blank line
ENDFOR // no need to type the  X, COMAL adds it for you
PRINT "Press a key to continue..."
```

Here we must emphasize one aspect of the Amiga. It is multi-tasking. It can do more than one thing at a time. AmigaCOMAL provides a proper way to wait for a keypress so that other tasks are not slowed down: WAIT. Wait will wait for a keypress or right mouse button. You also may include a number after it, specifying the number of seconds to wait. Example: WAIT 5.

So, Amiga users, still in AUTO mode, type this line next:

```
WAIT
```

Other COMAL users type this line instead:

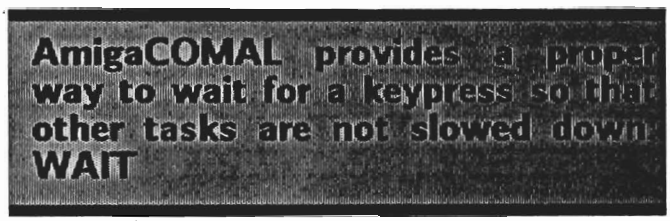
```
WHILE KEY$="" DO NULL
```

Note: Power Driver sees no keypress as a CHR$(0) rather than a null string. It would use the following line:

```
WHILE KEY$=CHR$(0) DO NULL
```

To allow for Power Driver, you could use the following line with every COMAL:

```
WHILE KEY$<CHR$(1) DO NULL
```



Now, still in AUTO mode, finish the program:

```
DATA 0,"junk" // this will be skipped over by RESTORE
TITLES:
DATA "Ahls Benchmark"
DATA "Calc Benchmark"
DATA "Sieve Benchmark"
DATA "Substring Benchmark"
AMIGA:
DATA 3.1,12.8,7.2,16.9,6.6,16.0,0.2,5.1 // Amiga
```

Stop the AUTO mode here (see note above on how to do that). The last line contains the time in seconds for benchmark tests run on an Amiga 500 comparing BASIC and COMAL. The data will be properly read and used on IBM and C64, however, it will be Amiga comparisons! To have the

comparisons be applicable to the computer being used, replace the last line with one of these:

```
DATA 10.2, 14.4, 32.8, 55.6, 8.6, 39.8, 0.3, 9.7 //IBM 2.2

DATA 25.5,115.7, 72.9,106.4, 28.0,137.4, 1.0,12.3 //C64 2
```

Of course, Amiga users can type in the data for IBM or C64 too, if they want to see the comparison for those computers.

Now, save your work before we continue:

```
SAVE "temp2"
```

That is the whole program ... except for the **bar** procedure! However, we can tack on that procedure easily now, in one of three different ways!

We could just merge the procedure into this program so the program includes everything:

```
MERGE "bar"
```

Power Driver uses the ENTER command instead of MERGE:

```
ENTER "bar"
```

You now have everything in one place. Have COMAL check it all out for you:

```
SCAN
```

Now, save the demo program:

```
SAVE "bardemo"
```

Try the program:

```
RUN
```

If you forgot what the **bar** procedure looked like, just list it. You can tell COMAL to list any procedure you want. Just specify the procedure name like this:

```
LIST bar
```

Power Driver does not allow listing procedures by name.

So far you have seen some of the flexibility of procedures. You have tested them from direct mode. You have merged them into a future program. You have listed them individually. But there is more to show you yet!

Sorry, but we must leave Power Driver users behind now.

COMAL 2.0 allows you to execute procedures directly from disk! The procedure itself does not have to be part of the running program. All you need is a special procedure header with an EXTERNAL specification at its end.

Let's demonstrate this right now. First list the **bar** procedure:

```
LIST bar
```

Now, delete the procedure:

```
DEL bar
```

Now put the cursor on the C of the word CLOSED at the end of the PROC header line that is still displayed on your screen. Amiga users can just point the mouse there and click the left mouse button. Others (and Amiga users too if they want) can use the cursor up and cursor right keys to get there.

Now type over the word CLOSED. Type this:

```
PROC bar(name$,max,num) EXTERNAL "bar.ext"
```

IBM and Amiga users do not have to specify the .ext filename extension, as COMAL will tack it on if you omit it.

List the program to verify that the procedure is indeed gone, and only the header remains:

```
LIST
```

Now, you can see that the program will still run, using the procedure it needs right from disk!

```
RUN
```

Next we will show how an EXTERNAL procedure can have a different name. The name of the procedure as saved to disk can be different than the name given in the procedure header that utilizes it! To do this, we will write a **bar** procedure with a slightly different look:

```
NEW
AUTO
PROC alternative(n$,max,num) CLOSED
  DIM bar$ OF 27 // will work on all screens
  bar$=3*"1234567890"//string multiplication/see note
  PRINT n$;bar$(1:(num/max)*27);
  PRINT USING "###.#": num
ENDPROC // COMAL will add the name for us later
```

End AUTO mode.

C64 COMAL does not have the string multiplication extension. Use these two lines instead to assign bar$ its value:

```
bar$=""
FOR x=1 TO 3 DO bar$:+"1234567890"
```

Have COMAL check out the procedure:

```
SCAN
```

Now make sure it works. Test it from direct mode:

```
alternative("test",23,9)
```

Now, we want to save it on disk with the same name as the original **bar** external procedure. Since you don't want to lose your original procedure, rename that file first:

```
RENAME "bar.ext","bar1.ext"
```

Now you can save our new procedure on disk as an external procedure:

```
SAVE "bar.ext"
```

Now, run the bardemo program we previously saved to disk (unchanged mind you):

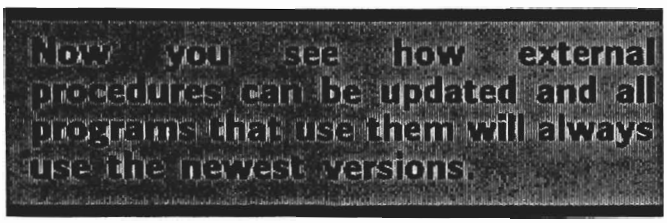
```
RUN "bardemo"

>>>>> Ahls Benchmark
COMAL 123456   3.1
BASIC 12345678901234567890123456   12.8

>>>>> Calc Benchmark
COMAL 12345678901   7.2
BASIC 12345678901234567890123456   16.9

>>>>> Sieve Benchmark
COMAL 12345678901   6.6
BASIC 12345678901234567890123456   16.0

>>>>> Substring Benchmark
COMAL 1   0.2
BASIC 12345678901234567890123456   5.1
```



Now you see how external procedures can be updated and all programs that use them will always use the newest versions ... as long as you keep the same filenames and number and type of parameters. Packages offer this same advantage, but they were out of reach to the normal COMAL programmer ... until now.

Now we leave all the COMALs behind except AmigaCOMAL. (IBM COMAL 3.0 also can do this, but with a more complex process, so it will be covered in a future article.) We will show how easy it is to access the **bar** procedure in the bar package we created earlier. First, delete the **bar** procedure header line:

```
DEL bar
```

Then just add this line at the beginning of the program:

```
1 USE bar
```

The program will run just like before, except now you are using a procedure from a package!

References:

Listerine, Will Bow / R. Hughes, *COMAL Today #24*, page 64

Reveal PROCs, Dick Klingens, *COMAL Today #18*, page 60

Easy Instructions, Captain COMAL, *COMAL Today #16*, page 24

Introduction to Procedures, David Stidolph, *COMAL Today #15*, page 36

Procedures and Functions - Our Collection, *COMAL Today #15*, page 40

Merger, David Stidolph, *COMAL Today #15*, page 50

Program Construction, Captain COMAL, *COMAL Today #15*, page 51

Keywords, Procedures, Packages, Richard Bain, *COMAL Today #14*, page 32

Listerine, Will Bow, *COMAL Today #14*, page 22

COMAL 2.0 External Procedures, Captain COMAL, *COMAL Today #7*, page 27

Automated PROC & FUNC Librarian, Kevin Quiggle, *COMAL Today #6*, page 75

Pass an Array as a Parameter, Captain COMAL, *COMAL Today #4*, page 48

Function as a Parameter / Local and Global, *COMAL Today #2*, page 32 ■

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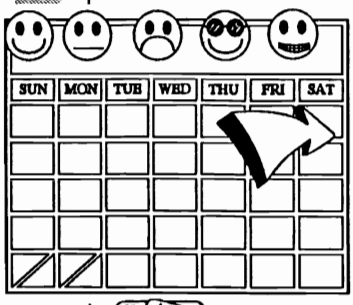

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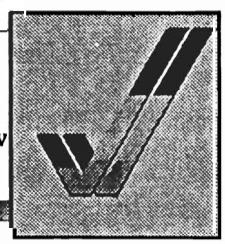

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Power Driver Variable Storage

by David Warman

While writing the Power Driver BUFFER routines, I uncovered some information on how variables are stored in memory. It is sketchy, but may provide a starting point for anyone wishing to investigate further.

```
Pointer Memory Area Description
        :-----------------------------:
$38-39 :COMAL program                 :
        :-----------------------------:
$3C-3D :name table/$3E-3F=end of table:
        :-----------------------------:
$3A-3B :variable location table       :
        :-----------------------------:
        :free memory                  :
        :-----------------------------:
$40-41 :variables                     :
        :-----------------------------:
$42-43 :DIM'ed variables              :
        :-----------------------------:
$44-45 :top of memory                 :
        :-----------------------------:
```

COMAL program is simply the lines that make up the program, without the name table or variables.

Name table is a list of the names of all the variables, PROCs, and FUNCs used in the program, **including all typing errors and any old names that may have been changed.** Once a name has been defined, it stays in the name table and is SAVEd along with the program. **The only way to get rid of an unused name is to LIST the program to disk, then ENTER it back.** This process builds up a new name table, consisting of only the current names. The format of the name table is a length byte followed by the ASCII representation of the name. The end of the name table is marked by a zero byte. Example, if a program has two variables, min and max, the name table would look like this:

```
3   77  73  78  3   77  65  88  0
Len m   i   n   Len m   a   x   end
Len = Length of name (3 in each case)
```

The variable location table is arranged in groups of five bytes that provide information on each name. These 5-byte groups are in the same order as the names in the name table. The first byte determines what the name is: integer variable, string array, simple real, PROC, etc. The numbers that represent each type are listed in *COMAL Today #9*, page 68, in the PROC printtype. This is for 2.0, but the values appear to be the same in Power Driver. The second and third bytes are the lo-byte and hi-byte, respectively, of the exact memory location of the variable. I haven't yet determined the purpose of the fourth and fifth bytes.

After the variable location table is an area of free memory. It's size is returned by FREE and SIZE. Variables are stored at the top of memory, first the simple nondimensioned variables, then just before end of memory, the dimensioned strings & arrays.

Reference:

Change Drive - Power Driver, *COMAL Today #24*, page 67

Power Driver Turtle Parameters, R. Hughes, *COMAL Today #24*, page 62

Power Driver Memory Location, R. Hughes, *COMAL Today #24*, page 58

Show COMAL Name Table, Mike Lawrence, *COMAL Today #9*, page 68

COMAL 0.14 Memory Map, *COMAL Today #6*, page 28 ■

Power Turtle Functions

by Leo R. Reed

While reading my issue of *COMAL Today #24*, I noticed an article *Power Driver Turtle Parameters* by R. Hughes on page 62. His FUNCtions x'pos and y'pos may suffice while the turtle is in the visible area of the viewing screen. They are not sufficient for keeping track of the turtle when it is off screen. Also, note that programs that are compiled need different PEEKs than those running under the Power Driver interpreter!

Power Driver Interpreter FUNCtions:

```
FUNC xcor CLOSED
  hi#=PEEK(28742) // for Power Driver
  RETURN ((hi# * 256 + PEEK(18127))-(hi# DIV 128) * 65536
ENDFUNC xcor
//
FUNC ycor CLOSED
  hi#=PEEK(28746) // for Power Driver
  lo#=PEEK(28747)
  IF hi#>128 OR (hi#=128 AND lo#>199) THEN
    RETURN 256 * (256-hi#) + 199 - lo#
  ELIF hi#<=128 THEN
    RETURN (256 * (256 - hi#) - lo# + 199) - 65536
  ENDIF
ENDFUNC ycor
```

Power Driver Compiler FUNCtions:

```
FUNC xcor CLOSED
  hi#=PEEK(18126) // for Power Driver COMPILER
  RETURN ((hi# * 256 + PEEK(18127))-(hi# DIV 128) * 65536
ENDFUNC xcor
//
FUNC ycor CLOSED
  hi# = PEEK(18130) // for Power Driver COMPILER
  lo# = PEEK(18131)
  IF hi#>128 OR (hi#=128 AND lo#>199) THEN
    RETURN 256 * (256 - hi#) + 199 - lo#
  ELIF hi#<=128 THEN
    RETURN (256 * (256 - hi#) - lo# + 199) - 65536
  ENDIF
ENDFUNC ycor ■
```

COMAL: The Next Generation

Two new COMAL implementations represent the next generation of COMAL: IBM PC COMAL 3.0 from UniComal and AmigaCOMAL from ComWare. Though we have not received a formal announcement, it seems that the AmigaCOMAL developers have joined together with UniComal (who also were the developers of the C64 and C128 COMAL cartridges). With all those brilliant programmers working together, the future of COMAL seems secure!

UniComal's goals are to continuously develop and maintain UniComal program development tools so that users are assured access to the newest programming techniques, rapid execution speed and a high level of user friendliness. Their new IBM PC COMAL 3.0 is an expression of these goals. Two years of development time has been invested in the 3.0 implementation. The result was a program development tool with many intelligent facilities that can only be obtained otherwise by combining the features of several other programming languages.

Likewise, AmigaCOMAL has been under development since the Amiga was first released. It was created with guidance from Borge Christensen, the father of COMAL. While it includes many advanced features, it maintains what has become a trademark of COMAL. It is totally user friendly!

Both AmigaCOMAL and IBM PC COMAL 3.0 have many similar advancements. It is easy to see that they have been cooperating with each other, even while working as two separate companies!

Record Structures! On the Amiga these are implemented through a RECORD structure. IBM uses a STRUC structure. Both allow you to refer to all the variables in the data structure as one thing ... or to refer to individual variables in the structure separately.

Packages may be written in COMAL, C or Assembler! Packages have always been easy to use by all, even the beginner! Now it is possible for anyone to write their own package too. Packages (called modules in IBM 3.0) may be written in COMAL itself. A user can find out what new commands are added by any package with two easy steps:

- First USE the package (module):

```
USE «packagename»
```

- Next, ask for the list of new commands:

```
LISTPACK «packagename» // AmigaCOMAL & IBM 2.2
INTERFACE «packagename» // IBM 3.0
```

Pointers and pointer variables have been introduced in these next generation COMALs. It is now possible to define dynamic data structures to take advantage of the efficient memory usage which this entails (such as lists and trees).

Both Amiga and IBM 3.0 allow the programmer to utilize as much memory as needed (within the limit of available memory in the computer). You also may declare arrays which are larger than 64K.

Both also can handle external **events**. Example: execute a procedure each time a device requests service. It is also possible to designate the priority of events. This facility is very important to the efficiency and updating of a program in connection with control tasks, data logging, etc.

IBM PC COMAL 3.0 has also expanded the **PRINT USING** statement so that text can easily be printed together with numbers in various formats. The **INPUT** statement also was extended with additional termination options. Full **network support** is also available as an option.

Both Amiga and IBM implementations were produced in Denmark. Thus it is easy to see why they went out of their way to support the national differences, in particular the different character sets (NLS).

The new **Profile Concept** gives IBM PC programmers the ability to easily configure version 3.0 according to their special requirements. AmigaCOMAL utilizes a **Preferences** file for the same capability, and includes an INSTALL program that makes creating the preferences file easy.

In addition to the facilities and features mentioned above, a number of other improvements have been made. For example: several program structures have been improved (LOOP «number» TIMES), the full screen editor has been made even easier to use (with full mouse controls on the Amiga), improved string handling (string multiplication), better program structure checking, improved commands, and much more.

Other programming languages have been improving in the past years. However, COMAL remains a jump ahead of them with these next generation implementations.

Special IBM note: Both versions 2.2 and 3.0 of IBM PC COMAL are current and supported. Version 2.2 has dropped in price to just $165 including its compiler. Special school licenses are available. It is still ideal for the non-professional programmer! See the benchmark times on page 21.■

Power Driver BUFFER

by David Warman

I like writing programs in Power Driver since they can be used by people who do not have the 2.0 cartridge, and can even be compiled and distributed to people without any form of COMAL, possibly bringing in some new COMAL users in the process. However, one drawback of Power Driver, even though it's a great improvement over COMAL 0.14, is the 15K memory limit. I often feel restricted by this limitation, especially after being used to the cartridge. It occurred to me that I might be able to store data in the 8K area under the Kernal ROM at $E000, so I set about learning how to do this. The result is the machine language program called "ml.buffer/pwr".

BUFFER adds 7615 bytes of memory for data or text.

I'll refer to this memory area as a BUFFER, since it is similar to COMAL 2.0's "pkg.buffer", which utilizes the memory under the cartridge. This routine does not increase program memory; you still have 15K of program space. It is a special area of memory, like BASIC's $C000 area; it can be thought of as a relative file in memory. You can use it to store text or data. **Another feature of the BUFFER is that any data in it survives from one program to another.** Therefore, data can be placed in the BUFFER by one program, and retrieved by a program that is CHAINed from the first one.

The program "buffer/pwr.procs" contains all the necessary PROCs to install the ML and transfer data between the BUFFER and the program. The first three procedures set up the machine language. If you need more memory for your program, you can put these in a loader program that sets up the buffer, then CHAINs your main program.

init'buffer

This PROC calls the other two PROCs.

load'obj(«filename$»)
Example: load'obj("ml.buffer/pwr")

Loads the ML program "ml.buffer/pwr". The ML resides at $E000, and handles the transfer of data between the COMAL program and the BUFFER.

poke'irq

POKEs a short ML routine into the top part of the cassette buffer. It is relocatable, but if the location is changed, the SYS address in the read/write PROCs must also be changed. The routine in the cassette buffer prepares to call the BUFFER handling code at $E000 and is executed each time a call is made to one of the BUFFER read/write PROCs.

Buffer Data Transfer via BTEXT$

Transfer of data between a COMAL program and the BUFFER is via a string variable which must be named btext$. The reason is explained below.

Before write'buf or read'buf are called, the string btext$ should be DIM'ed to a length sufficient to hold the maximum length of data you want to transfer to or from the BUFFER at one time.

write'buf(«loc»)
Example: write'buf(15)

Copies the entire contents of btext$ into the BUFFER, starting at the location passed as the parameter (15 in the example). The location can range from 0 to about 7600.

read'buf(«loc»,«length»)
Example: read'buf(0,100)

Copies the contents of the BUFFER into btext$ starting at location «loc» and proceeding for «length» characters. The example reads from BUFFER locations 0-99 and stores those characters into the variable btext$. If «length» is greater than the DIMensioned length of btext$, btext$ will be filled and the extra characters will be ignored (truncated).

fill'buf(«loc»,«length»,«fill'char»)
Example: fill'buf(50,10,32)

This PROC will fill the BUFFER from «loc» to «loc»+«length»-1 with the ASCII value specified in «fill'char». The example puts spaces in BUFFER locations 50-59, since CHR$(32) is a space.

Optionally, to save memory, you can combine all the BUFFER read/write/fill PROCs into one PROCedure, as in PROC buffer in "buffer/pwr.procs". For the «type» parameter, use 0 to read from the BUFFER, 1 to write to it, and 255 to fill it.

file'to'buffer(«file$»,«bufpos»,«reclen»)
Example: file'to'buffer("test.dat",10,40)

Loads string data from a SEQ file into the BUFFER. «bufpos» is the BUFFER location at which you want the file to start loading, and «reclen» is the length of each string.

buffer'to'file(«file$»,«bufpos»,«reclen»,«recs»)
Example: buffer'to'file("temp.dat",10,40,100)

Saves the contents of the BUFFER into a SEQ file. «recs» is the total number of records to be written to disk; the other parameters are the same as for **file'to'buffer**.

As mentioned above, all data is passed to and from the BUFFER through a string called btext$. In writing this program, I had to do some research into how Power Driver stores variables in memory. The 0.14 memory map was of some help in finding the name tables, but it didn't describe just how variables are stored. I was unable to determine exactly how parameter variables operate, so I settled for using a string with a constant name that the machine language program could always find.

When a call is made to one of the BUFFER read/write PROCedures, the values of the parameters are first POKEd into locations in the cassette buffer. Then the COMAL PROC executes a SYS to address 992, also in the cassette buffer, which prepares to jump to the BUFFER-handling routine under the Kernal at $E000.

Normally, data cannot be read from under the Kernal; first the interrupts must be disabled, then the Kernal must be banked out so that the RAM underneath it can be read. The code in the cassette buffer takes care of all this, then jumps to $E000 to perform the actual read/write. After this is done, the program jumps back to the cassette buffer where the Kernal is banked back in, the interrupts are re-enabled, and control is returned to the COMAL program.

This version has some restrictions which I hope to solve in a future version.

- The variable btext$ cannot be passed as a parameter to any PROC which executes calls to the BUFFER. Parameter variables are handled differently than other variables, and I haven't yet been able to figure out how they work.

- Care must be taken not to write data past the end of the BUFFER. The program performs checks to make sure data is not written outside the BUFFER, but no error is communicated to the user; the action is simply aborted. The exact size of the BUFFER area is 8192 bytes, but the ML uses 577 bytes, leaving 7615 bytes (BUFFER locations 0-7614). In addition, there is a Kernal routine which writes data to a section of RAM high in the BUFFER area. From what I've been told, this only occurs on a warm or cold start, which writes data to $FD30-$FD4F. So, pressing «RUN/STOP» + «RESTORE» may destroy 32 bytes of data. If you want to avoid this area, don't use BUFFER locations 6895-6926.

- Since this routine uses the same area as the graphicscreen, it is incompatible with programs that use graphics.

- Programs that use the BUFFER cannot be compiled. This is because the name table pointers that the ML reads get moved when the program is compiled, and I haven't been able to find where they are moved to.

If and when I solve any of these problems, I'll release an updated version. I hope this program proves useful!

Note: This is version 1.1 of "ml.buffer/pwr". An earlier version had an abbreviated fill feature; it could only fill the entire BUFFER with zeroes. You can find the version number of these and future versions with this program:

```
DIM version$ OF 10
OPEN FILE 5,"ml.buffer/pwr"
version$=GET$(5,10)
CLOSE 5
PRINT version$(7:9)
```

SETUP BUFFER

In order to use the BUFFER procedures described above, you must have the Machine Language (ML) in memory! This ML is contained in the file "ml.buffer/pwr" on *Today Disk 25*, and is loaded by the PROC load'obj in the program just discussed. If you wish to type in the BUFFER program, you also must type in the SETUP BUFFER program, which is a substitute for the ML file you do not have.

SETUP BUFFER will read the machine language from DATA statements and POKE it into memory. Once the ML is in memory it will stay there until the power is turned off or the graphic screen is activated, so this program is only needed to set up the ML. You can LOAD or CHAIN other programs after RUNning this one.

If you use this program to set up the ML, you should delete the PROC load'obj from "buffer/pwr.procs", as well as the program line in PROC init'buffer that calls it.

Reference:

Text Package, Dick Klingens, *COMAL Today #11*, page 63
Text Package, Dick Klingens, Package Library Volume 2, page 51

BUFFER/PWR.PROCS

```
PROC init'buffer
  //This PROC must be called before BUFFER commands can be
  //used. The file  "ml.buffer/pwr"  must be on the disk
  //OR you must first run the program SETUP BUFFER.
  DIM btext$ OF 100 //this number is the max transfer size
  poke'irq
  // omit the next line if you are using SETUP BUFFER
  load'obj("ml.buffer/pwr")
ENDPROC init'buffer
//
PROC poke'irq
  //This routine is relocatable
  //It prepares to call the BUFFER handling code at $E000
  FOR address:=992 TO 1009 DO
    READ byte
    POKE address,byte
  ENDFOR address
  DATA 120 //     sei
  DATA 165,1 //   lda $01
  DATA 41,253 //  and #$fd
  DATA 133,1 //   sta $01
  DATA 32,0,224 //jsr $e000
  DATA 165,1 //   lda $01
  DATA 9,2 //     ora #$02
  DATA 133,1 //   sta $01
  DATA 88 //      cli
  DATA 96 //      rts
ENDPROC poke'irq
//
PROC load'obj(name$) // omit if using SETUP BUFFER
  POKE 157,0
  POKE 858,169
  POKE 859,0
  POKE 860,76
  POKE 861,213
  POKE 862,255
  OPEN FILE 78,name$+",p",READ
  SYS 858
  CLOSE FILE 78
ENDPROC load'obj
//
//Below are the BUFFER PROCs. Two methods can be used.
//Parameter storage:
//Loc 1010=type  0=read
//               1=write
//             255=fill buffer
//Loc 1011-1012=buffer location
//Loc 1013-1014=# bytes to read
//Loc 1015=ASCII value for fill
//
//--------- Method 1 ----------
//  (Separate PROC for each function)
PROC read'buf(loc,length)
  POKE 1010,0 //read
  POKE 1011,loc MOD 256
  POKE 1012,loc DIV 256
  POKE 1013,length MOD 256
  POKE 1014,length DIV 256
  SYS 992
ENDPROC read'buf
//
PROC write'buf(loc)
  POKE 1010,1 //write
  POKE 1011,loc MOD 256
  POKE 1012,loc DIV 256
  SYS 992
ENDPROC write'buf
//
PROC fill'buf(loc,length,fill'char)
  //fill BUFFER with <fill'char>
  POKE 1010,255
  POKE 1011,loc MOD 256
  POKE 1012,loc DIV 256
  POKE 1013,length MOD 256
  POKE 1014,length DIV 256
  POKE 1015,fill'char
  SYS 992
ENDPROC fill'buf
//
// ---------- Method 2 ----------
// (One PROC for read, write & fill)
//
// Use dummy values for un-needed parameters.
// Example calls:
//   buffer(1,30,0,0) //read
//   buffer(127,0,write',0) //write
//     No length parm needed;
//     Entire string "btext$" is stored
//     Assumes write'=1
//   buffer(5,20,255,32) //fill
//
PROC buffer(loc,length,type,fill'char)
  POKE 1010,type //read,write,or clear
  POKE 1011,loc MOD 256
  POKE 1012,loc DIV 256
  POKE 1013,length MOD 256
  POKE 1014,length DIV 256
  POKE 1015,fill'char
  SYS 992
ENDPROC buffer
//
//Use the following PROCs to load a SEQ file into the
//BUFFER, and to save the BUFFER to a file.
//
PROC file'to'buffer(filename$,bufpos,record'len)
  IF file'exists(filename$) THEN
    OPEN FILE 11,filename$,READ
    WHILE NOT EOF(11) DO
      READ FILE 11: btext$
      write'buf(bufpos)
      bufpos:+record'len
    ENDWHILE
  ELSE
    PRINT STATUS$
  ENDIF
  CLOSE FILE 11
ENDPROC file'to'buffer
//
PROC buffer'to'file(filename$,bufpos,record'len,records)
  PASS "s0:"+filename$
  OPEN FILE 11,filename$,WRITE
  FOR i#:=1 TO records DO
    read'buf(bufpos,record'len)
    WRITE FILE 11: btext$
    bufpos:+record'len
  ENDFOR i#
  CLOSE FILE 11
ENDPROC buffer'to'file
```

SETUP BUFFER

Use this program to install the ML if you do not have the file "ml.buffer/pwr" on Today Disk 25. You only need to run it once, as the ML will stay installed until the power is turned off or you use the graphicscreen.

```
// by David Warman
PAGE
RESTORE
checksum:=0
address:=57344 //$E000
PRINT "Working..."
WHILE NOT EOD DO
  READ byte
  POKE address,byte
  address:+1
  checksum:+byte
ENDWHILE
IF checksum<>83972 THEN
  PRINT "Checksum error. Please check data."
ELSE
  PRINT "BUFFER code installed."
ENDIF
//
DATA 76,39,224,86,49,46,49,32,66,89,32,68,65,86
DATA 73,68,32,87,65,82,77,65,78,66,84,69,88,84,0,1
DATA 0,0,0,0,0,0,0,0,0,173,242,3,201,0,240,10
DATA 201,255,208,3,76,30,225,76,196,224,32,218,225,32,89,225
DATA 173,28,224,240,3,76,252,225,32,171,225,173,32,224,133,254
DATA 173,33,224,133,255,160,1,56,177,254,237,245,3,136,177,254
DATA 237,246,3,176,12,200,177,254,141,245,3,136,177,254,141,246
DATA 3,32,17,226,173,28,224,240,3,76,252,225,173,246,3,141
DATA 38,224,160,0,174,245,3,177,252,145,254,200,192,0,208,4
DATA 230,253,230,255,202,224,0,208,238,173,246,3,201,0,240,6
DATA 206,246,3,76,133,224,173,32,224,133,254,173,33,224,133,255
DATA 160,2,173,38,224,141,246,3,173,246,3,145,254,200,173,245
DATA 3,145,254,76,252,225,32,218,225,32,89,225,173,28,224,240
DATA 3,76,252,225,32,171,225,173,32,224,133,254,173,33,224,133
DATA 255,160,2,177,254,141,246,3,200,177,254,141,245,3,32,17
DATA 226,173,28,224,240,3,76,252,225,160,0,174,245,3,177,254
DATA 145,252,200,192,0,208,4,230,253,230,255,202,224,0,208,238
DATA 173,246,3,201,0,240,6,206,246,3,76,252,224,76,252,225
DATA 32,218,225,32,17,226,24,165,252,109,245,3,133,254,165,253
DATA 109,246,3,133,255,144,8,169,255,133,254,169,255,133,255,160
DATA 0,173,247,3,145,252,230,252,208,2,230,253,166,254,228,252
DATA 208,242,166,255,228,253,208,236,76,252,225,165,60,133,254,165
DATA 61,133,255,160,0,162,0,177,254,201,0,208,4,238,28,224
DATA 96,141,30,224,201,5,240,33,238,29,224,238,31,224,173,31
DATA 224,201,0,208,2,230,255,173,30,224,24,109,31,224,168,141
DATA 31,224,144,209,230,255,76,99,225,200,192,0,208,2,230,255
DATA 177,254,221,23,224,208,209,232,224,5,208,237,96,165,58,133
DATA 254,165,59,133,255,206,29,224,162,5,169,1,24,109,29,224
DATA 144,2,230,255,202,224,0,208,243,168,177,254,141,32,224,200
DATA 192,0,208,2,230,255,177,254,141,33,224,96,169,1,141,29
DATA 224,169,0,141,31,224,141,28,224,165,254,141,34,224,165,255
DATA 141,35,224,165,252,141,36,224,165,253,141,37,224,96,173,34
DATA 224,133,254,173,35,224,133,255,173,36,224,133,252,173,37,224
DATA 133,253,96,165,254,24,105,4,133,254,144,2,230,255,24,169
DATA 65,109,243,3,133,252,169,226,109,244,3,133,253,144,3,238
DATA 28,224,24,165,252,109,245,3,165,253,109,246,3,144,3,238
DATA 28,224,96
```

Power Driver BUFFER Demo

This program demonstrates the use of the BUFFER commands. Do not type the PROC load'obj if you use SETUP BUFFER, and omit the line in init'buffer that calls it.

```
// by David Warman - Aug. 23, 1989
init
title
demo
//
PROC init
  DIM reply$ OF 1, btext$ OF 2000
  DIM text$ OF 40
  BACKGROUND 0
  BORDER 0
  TRAP ESC-
ENDPROC init
//
PROC demo
  PAGE
  PRINT AT 2,1:"Reply ""y"" if you haven't loaded"
  PRINT "the ML since turning on the power."
  INPUT AT 1,1:"Load ML? ": reply$
  IF reply$="y" THEN init'buffer
  PAGE
  PRINT "Throughout this demo, use these"
  PRINT "commands:"
  PRINT "w: write INPUT'ed text to buffer"
  PRINT "r: read text from buffer and display"
  PRINT "f: fill buffer"
  PRINT "STOP: to end demo"
  REPEAT
    reply$:=INKEY$
    CASE reply$ OF
    WHEN "w"
      PRINT "Enter text: (two lines max)"
      INPUT ">": btext$
      INPUT "Position to write to: ": loc
      write'buf(loc)
      PRINT "Written..."
    WHEN "r"
      INPUT "Position to read from: ": loc
      INPUT "Number of bytes to read: ": length
      read'buf(loc,length)
      PRINT "Text from BUFFER:"
      PRINT "",btext$
    WHEN "f"
      INPUT "First position to fill : ": loc
      INPUT "Number of bytes to fill: ": length
      INPUT "ASCII value to fill with: ": fill'char
      fill'buf(loc,length,fill'char)
      PRINT "Filled..."
    OTHERWISE
      IF ESC THEN
        PRINT "Demo finished."
        END
      ENDIF
    ENDCASE
  UNTIL TRUE=FALSE
ENDPROC demo
//
PROC init'buffer
  poke'irq
  // omit next line if you used SETUP BUFFER
  load'obj("ml.buffer/pwr")
ENDPROC init'buffer
```

Power Driver BUFFER (continued)

```
//
PROC poke'irq
  FOR address:=992 TO 1009 DO
    READ byte
    POKE address,byte
  ENDFOR address
  DATA 120 //      sei
  DATA 165,1 //    lda $01
  DATA 41,253 //   and #$fd
  DATA 133,1 //    sta $01
  DATA 32,0,224 //jsr $e000
  DATA 165,1 //    lda $01
  DATA 9,2 //      ora #$02
  DATA 133,1 //    sta $01
  DATA 88 //       cli
  DATA 96 //       rts
ENDPROC poke'irq
//
//Omit the following procedure if you use
//the SETUP BUFFER program
PROC load'obj(name$)
  POKE 157,0
  POKE 858,169
  POKE 859,0
  POKE 860,76
  POKE 861,213
  POKE 862,255
  OPEN FILE 78,name$+",p",READ
  SYS 858
  CLOSE FILE 78
ENDPROC load'obj
//
PROC read'buf(loc,length)
  POKE 1010,0 //read
  POKE 1011,loc MOD 256
  POKE 1012,loc DIV 256
  POKE 1013,length MOD 256
  POKE 1014,length DIV 256
  SYS 992
ENDPROC read'buf
//
PROC write'buf(loc)
  POKE 1010,1 //write
  POKE 1011,loc MOD 256
  POKE 1012,loc DIV 256
  SYS 992
ENDPROC write'buf
//
PROC fill'buf(loc,length,fill'char)
  //fill BUFFER with <fill'char>
  POKE 1010,255 //fill
  POKE 1011,loc MOD 256
  POKE 1012,loc DIV 256
  POKE 1013,length MOD 256
  POKE 1014,length DIV 256
  POKE 1015,fill'char
  SYS 992
ENDPROC fill'buf
//
PROC title
  PAGE
  PRINT AT 1,8:"Demo of BUFFER PROCedures"
  PRINT TAB(12),"by David Warman"
  PRINT "This BUFFER routine is similar to the"
  PRINT "BUFFER package for COMAL 2.0, except"
  PRINT "that it is for Power Driver."
  PRINT "Following is an example of each of the"
  PRINT "BUFFER functions:"
  PRINT "Write contents of <btext$> to BUFFER."
  PRINT " write'buf(1)"
  PRINT " The entire string <btext$> is stored"
  PRINT " in the BUFFER, starting at BUFFER"
  PRINT " location 1."
  wait
  PAGE
  PRINT "Read buffer into <btext$>."
  PRINT " read'buf(75,100)"
  PRINT " The contents of the BUFFER, starting"
  PRINT " at position 75 and proceeding for 100"
  PRINT " characters, are copied into <btext$>."
  PRINT " If <btext$> is DIM'ed less than 100"
  PRINT " bytes, it will be filled to its"
  PRINT " maximum length."
  PRINT "Fill BUFFER."
  PRINT " fill'buf(76,25,32)"
  PRINT " Fills BUFFER locations 76-100 with"
  PRINT " spaces.  The first parameter specifies"
  PRINT " the first BUFFER location to fill, the"
  PRINT " second parameter is the number of"
  PRINT " locations to fill, and the last"
  PRINT " parameter is the ASCII value of the"
  PRINT " character you want to fill the BUFFER"
  PRINT " with."
  wait
ENDPROC title
//
PROC wait
  PRINT AT 25,6:"Press any key to continue...",
  WHILE KEY$<>CHR$(0) DO NULL
  WHILE KEY$=CHR$(0) DO NULL
ENDPROC wait
//
PROC viewfile(filename$)
  PAGE
  PRINT "Looking at file:";filename$
  PRINT
  IF file'exists(filename$) THEN
    done:=FALSE
    TRAP ESC-
    OPEN FILE 2,filename$,READ
    WHILE NOT (EOF(2) OR ESC OR done) DO
      INPUT FILE 2: text$
      PRINT text$
      shift'wait
    ENDWHILE
    CLOSE
    INPUT "Press <return> to continue: ": reply$
    TRAP ESC+
  ENDIF
ENDPROC viewfile
//
PROC shift'wait CLOSED
  shift'flag:=653; ok:=PEEK(shift'flag)
  WHILE NOT ok DO
    ok:=PEEK(shift'flag)
    IF ESC THEN ok:=TRUE; done:=TRUE
    PRINT "press shift"+CHR$(145)
    PRINT "           "+CHR$(145)
  ENDWHILE
ENDPROC shift'wait
//
FUNC file'exists(filename$) CLOSED
  DIM ds$ OF 2
  OPEN FILE 79,filename$,READ
  ds$:=STATUS$
  CLOSE FILE 79
  RETURN ds$="00"
ENDFUNC file'exists ■
```

Textbuffer Package

by David Warman (QLink = DavidW57)

This package for C64 COMAL 2.0 provides up to approximately 22K of memory for use by COMAL programs. This extra memory doesn't mean that programs can be 52K bytes in length (22K plus the normal 30K), or that arrays can be larger. It is a special area of memory that is accessed by the PROCedures and FUNCtions in the package. If you are familiar with either the **text** or **buffer** package, then you know how **textbuffer** works.

The **text** package, first published in *COMAL Today #11*, allows you to use the 16K area of RAM under the COMAL cartridge to store text (or numeric data converted to string format). The drawback is that it only allows you to read or write data starting at the beginning of the file and proceeding straight through to the end, similar to working with a SEQ file on disk. This is fine for many applications, but sometimes it is necessary to access data in a non-linear manner.

The **buffer** package uses the same 16K area, but gives you instant access to any location within the buffer, similar to a random access file. As far as I know, the **buffer** package was only included on the Packages Library Volume 1 disk, so many COMAL users may be unaware of it. (*In addition, it was LINKed to the program "singledrive'copy" on Cartridge Demo Disk #1 and I've used it in some of my programs on COMAL Today disks.*)

This package gives you about 22K of random access text storage.

My **textbuffer** package is similar to the **buffer** package, but offers some improvements. In addition to using the 16K of RAM under the cartridge, this package also gives you the option to use the 8K area of memory under the Kernal ROM and lets you save the data in the buffer along with a program. Below is a description of all the commands in the package. (*Note: this is the package version of the Power Driver program "ml.buffer/pwr", which uses the RAM under the Kernal - and also is in this issue.*)

All the non-string parameters in the following commands are integers, except those in the **definebuf** PROCedure which are real numbers.

readbuf(«text$»,«loc»,«len»)

This will read «len» bytes from the buffer, starting at buffer location «loc». Buffer locations are numbered starting with zero. The contents of the buffer will be placed in the string variable passed in the «text$» parameter. If the string is not DIM'ed high enough to hold the number of bytes specified, it will be filled to it's maximum DIMensioned length.

writebuf(«text$»,«loc»)

This command will write the contents of «text$» to the buffer, starting at location «loc». If an attempt is made to read or write past the end of the buffer, a TRAPpable error will be generated.

fillbuf(«loc»,«len»,«num»)
Example: fillbuf(0,100,32)

This command fills the buffer from location «loc» to «loc»+«len»-1 with the number «num». The example fills the first 100 bytes of the buffer with chr$(32), which is a space.

definebuf(«strt»,«end»,«use'hi»,«hi'strt»,«hi'end»)
Example:definebuf(ml'end+1,49151,true,$e000,$ffff)

This command sets up the actual memory locations that the buffer will use, and is generally executed only once, if at all. If you don't use this command the default values will be used.

I included this option in an effort to make **textbuffer** work with other packages. The **text** and **buffer** packages both use the entire area under the cartridge from $8009 to $bfff, making it impossible to use them with most other packages, since nearly all packages use this same RAM area. (*It may be possible to use text and buffer in conjunction with other packages that reside high in the under-cartridge-RAM, as long as you don't fill the buffer too full!*)

The **textbuffer** code itself begins at $8009, but I included the source code so that it can be relocated if necessary, if you have the right assembler. For example, if you are using another package which starts at $9000 and goes to $9500, you can assemble **textbuffer** at $9501. Then you must decide where to put the buffer itself; that's what the parameters control.

It needs to be explained here that the buffer is in two non-contiguous parts, one under the cartridge between $8009 and $bfff, which I'll call the lower buffer, and the other part - the upper buffer - under the Kernal ROM from $e000 to $ffff. However, it functions as if the two parts were one consecutive memory block.

The lower part of the buffer can be placed anywhere between $8009 and $bfff, as long as it doesn't overwrite the ML - a TRAPpable error will

be produced if you attempt this. In fact, the buffer area can even be before the ML. The start and end points are indicated by the memory addresses passed in the parameters «strt» and «end». The third parameter should be TRUE or FALSE, indicating whether or not you want to use the high part of the buffer. If you don't use it, the remaining parameters are irrelevant.

If you want to use the high part of the buffer, the parameters «hi'strt» and «hi'end» can be used to put it anywhere from $e000 to $ffff, inclusive. The only reason I can think of to not use this whole area is that there is a Kernal routine which (unintentionally?) writes to a few locations near the end of this area. I think the only time this happens is during a warm or cold reset, but if you want to avoid any trouble, set the top of the upper buffer below $fd30, since locations $fd30 to $fd4f may be altered. Also, if you use high RAM, you won't be able to use the graphicscreen, since it occupies the same memory locations.

ml'start

Returns the start address of the textbuffer package. It is really only useful for determining where to place the buffer area, to avoid overlap.

ml'end

Returns the end address of the ML. The statement:

```
definebuf(ml'end+1,49151,TRUE,$e000,$ffff)
```

would place the lower buffer immediately after the ML. Note: these parameters are the default settings.

buf'start

Returns the start address of the lower buffer.

buf'end

Returns the end address of the lower buffer.

hibuf'start

Returns start address of the high part of the buffer (usually $e000, or 57344).

hibuf'end

Returns the end address of the high buffer.

keepbuf(«int»)
Example: keepbuf(TRUE)

The parameter should be TRUE or FALSE, telling COMAL whether or not to save the buffer contents along with the program and the package. When set to TRUE, you can save the text in the buffer along with a program, without having to load the buffer from a file each time. There are two restrictions. First, the buffer area must be after the ML in order to be saved, although it doesn't have to be immediately after it; everything from the beginning of the ML to the end of the buffer will be saved with the program. Second, only the lower buffer will be saved, not the part after $e000. In addition, the buffer won't be saved if the package is ROMmed (*see below*). The default for this command is FALSE.

rombuf(«int»)
Example: rombuf(FALSE)

If the parameter is TRUE, the textbuffer package will be ROMmed, meaning that it won't be saved with the program; it will stay in the computer's memory. In this way, you can LOAD one program with the textbuffer package LINKed to it, then, after executing rombuf(TRUE), you can CHAIN to other programs that don't have the package LINKed, thus saving disk space and reducing loading time. You only need a USE textbuffer statement in the CHAINed program to use the textbuffer commands. The default setting for this command is FALSE.

version'textbuffer$

Returns the version number of the package, along with additional information.

I also included on the disk a version of the package that is assembled at $a000, to provide more versatility for those who don't have the proper assembler.

TEXTBUFFER demo program

This simple program demonstrates how to use the textbuffer package by allowing the user to enter text into the buffer and then read it back. Note that the textbuffer package that is LINKed to this program is assembled at $a000, rather than $8009. This is so those without an assembler can de-LINK the package and have two versions, giving more flexibility in using it with other packages.

References:

Text Package, Dick Klingens, *COMAL Today #11*, page 63
De-Link a Package, Dick Klingens, *COMAL Today #11*, page 65
De-Link Package, Dick Klingens, *COMAL Today #18*, page 64
Buffer Package, Packages Library Volume 1 ■

ASCII Fields

by Jeffrey Sherwood

Programs which read and write disk data files are easily created using COMAL. Let's make it even easier by showing you a simple way to structure your data and at the same time make it compatible with other languages and all versions of COMAL. However, first we will review some data processing terms dealing with the storage of information in computer files.

A field is the smallest unit of data that has meaning in describing information. A group of related fields, treated as a unit, is called a record. Similar records are grouped into a file. One field (or more) may be designated as a key used for sequencing the file or for locating records. Records may be fixed or variable in length. Using fixed lengths is less flexible and more wasteful of disk space. Files may be either RANDOM (directly read) or sequential (read serially). We will be using sequential files here. COMAL supports two types of sequential files:

Binary files (recommended by the COMAL Handbook) are created by the WRITE FILE statement. Each record is preceded by a count of how many characters are in the record. The READ FILE statement is used to read these records. Binary files are only readable by the specific implementation of COMAL that wrote them.

ASCII files are created using the PRINT FILE statement and each record is followed by a delimiter (such as a comma). The INPUT FILE statement is used to read these records. ASCII files can be read by most computers.

Since we want the data files generated here to be useful to other languages and data processing programs we will use ASCII files.

We will develop a method of maintaining several data fields, each of variable length, that are combined into one string and written to disk. Note that other languages break up string INPUT using comma's as the delimiter between parts. COMAL will read in the entire string with one INPUT FILE statement. Your program can break the fields up into their separate parts.

Here are two examples of data that we could be enter into our sample data file:

```
Jones,John,123 1st St,Alpha City,WI,56789,555-1212
Smith,Steve,456 2nd Street,Beta Town,MI,54321,222-4432
```

Notice each field does not necessarily start in the same position within the record. The following two procedures will combine different fields into one string and separate them into a single string.

Note: FIELD is a keyword in some COMALs, so we use item$.

```
PROC separate(source$,REF item$()) CLOSED
  // Separate fields divided by commas in source$ into the
  // string array: item$()
  index:=0
  WHILE "," IN source$ DO
    comma:="," IN source$
    index:+1
    item$(index):=source$(1:comma-1)
    source$:=source$(comma+1:LEN(source$))
  ENDWHILE
ENDPROC separate
//
PROC combine(REF source$,REF item$(),num'items) CLOSED
  // Combine array elements into a single string with each
  // field separated by commas
  source$:=item$(1)
  FOR index:=2 TO num'items DO
    source$:=source$+","+item$(index)
  ENDFOR index
ENDPROC combine
```

The program listed at the end of this article uses a string array to keep the relevant information on an individual, and stores that information in an ASCII disk file. This information could be read in by another data base program (even one written in BASIC) or any other COMAL. Each element of the string array keeps part of the data on an individual:

```
Array element 1: Name
Array element 2: Address
Array element 3: City
Array element 4: State
Array element 5: Zip Code
Array element 6: Phone Number
```

In case of disaster, always keep several old generations of your data and backup the entire disk frequently. Comments or suggestions may be EMailed to JeffreyS5 on QLink.

This information could be read in by another data base program, even one written in BASIC.

```
DIM f$(6) OF 40, all'data$ OF 240, choice$ OF 1
REPEAT
  menu
  CASE choice$ OF
  WHEN "A","a"
    add'entry
  WHEN "L","l"
    print'entries
  WHEN "Q","q"
    quit
  OTHERWISE
    NULL
  ENDCASE
UNTIL TRUE=FALSE // forever, see quit option
//
PROC separate(source$,REF item$()) CLOSED
```

ASCII Fields (continued)

```
  // Separate fields divided by commas in source$ into the
  //  string array: item$()
  index:=0
  WHILE "," IN source$ DO
    comma:="," IN source$
    index:+1
    item$(index):=source$(1:comma-1)
    source$:=source$(comma+1:LEN(source$))
  ENDWHILE
ENDPROC separate
//
PROC combine(REF source$,REF item$(),num'items) CLOSED
  // Combine array elements into a single string with each
  //  field separated by commas
  source$:=item$(1)
  FOR index:=2 TO num'items DO
    source$:=source$+","+item$(index)
  ENDFOR index
ENDPROC combine
//
PROC add'entry
  INPUT "Name:    ": f$(1)
  INPUT "Address: ": f$(2)
  INPUT "City:    ": f$(3)
  INPUT "State:   ": f$(4)
  INPUT "Zip code:": f$(5)
  INPUT "Phone #: ": f$(6)
  combine(add'data$,f$(),6)
  OPEN FILE 2,"sample.dat",APPEND
  PRINT FILE 2: add'data$
  CLOSE FILE 2
ENDPROC add'entry
//
PROC menu
  PAGE
  PRINT AT 2,1: "Simple data base"
  PRINT AT 6,1: "A) Add entry"
  PRINT AT 8,1: "L) List entries"
  PRINT AT 10,1: "Q) Quit"
  REPEAT
    INPUT AT 14,1,1: "Choice: ": choice$
  UNTIL choice$ IN "AaLlQq"
ENDPROC menu
//
PROC print'entries
  OPEN FILE 2,"sample.dat",READ
  WHILE NOT EOF(2) DO
    INPUT FILE 2: all'data$
    separate(all'data$,f$())
    PRINT "Name:    ";f$(1)
    PRINT "Address: ";f$(2)
    PRINT "City:    ";f$(3)
    PRINT "State:   ";f$(4)
    PRINT "Zip Code:";f$(5)
    PRINT "Phone #: ";f$(6)
    PRINT
    IF NOT EOF(2) THEN
      INPUT "Press RETURN for next ": choice$
    ENDIF
  ENDWHILE
  PRINT "That's the end of the file"
  INPUT "Press RETURN for menu": choice$
  CLOSE FILE 2
ENDPROC print'entries
//
PROC quit
  PAGE
  PRINT "Done."
  END
ENDPROC quit ■
```

Tech Talk

by Robert Ross

While I rarely use GOTO, I hope it isn't entirely expunged, unless other statements are added for graceful loop exits or control. How about allowing EXIT in WHILE, REPEAT and FOR loops? *[AmigaCOMAL does allow this.]* Or perhaps something like **EXITFOR name**? *[I like that idea. It could be extended to EXITWHILE and EXITREPEAT too.]* And something like CONTINUE (as in C) to go on at the start of the next iteration of a FOR, WHILE, REPEAT or LOOP loop. Makes GOTO look good, right?

And though not really a part of COMAL, how about a requested editor feature? This is from one who doesn't like to often type #$%^'"(or). At least in C64 2.0, a name table is constructed as lines are entered. The type of a variable name may change as a program is written, but how about keeping track in the name table of the last type specified while editing and using that as a default type for subsequent lines? «name»:=«value» might start out as real for the first use if "#" or "$" were not specified. «name»#:=3 or «name»$:="abc", specifying a type, would change the default type so "#" or "$" would not have to be typed each time «name» were entered. A symbol would be needed to specify real, too. If a different type were needed -- as a formal parameter in a PROC or as a FOR index variable, for example -- specifying a type symbol would reset the default type.

[Interesting that you bring up a typeless variable now. Check Svend Pedersen's article on page 34 for similar thoughts.]

C64 2.0 Technical Disk

Robert Ross has done extensive and highly advanced work with COMAL 2.0. He has submitted a disk with programs we cannot thoroughly test, covering material too advanced for most readers. This includes:

- A patch for the META package (see *COMAL Today #10*, page 64).
- Character conversion functions package.
- Source to Sizzle fast loader.
- Interrupt driven timer for C64 2.0.

Anyone wanting a copy of these programs and associated text files on disk should send $2 to cover our costs and request the Robert Ross Technical Disk. ■

Prime Factoring Methods

by Bill Inhelder

In the days before microcomputers, the task of factoring a nine digit number into primes presented a substantial challenge. We used programmable calculators such as the Olivetti Programma P101. With a 24 by 18 inch footprint and a weight of about 40 pounds, they were immense by today's standards. Programming used a symbolic code and output was hard copy on 4 inch paper rolls. Efficient algorithms using minimal memory had to be designed to carry out tasks. Even so, the task of factoring a large number into primes could take as long as an hour! The same algorithm translated into BASIC and run on a microcomputer reduces the elapsed time by a factor of 6 (even more with COMAL).

The purpose of this article is to present the original algorithm ("primes") together with various improvements in order to create COMAL programs of increasing efficiency.

The original algorithm begins by dividing a given natural number by the following divisors: 2, 3, 5, 7, 9, ...; that is, 2 and the set of odd numbers. If division produces a zero remainder, that divisor is a factor and is printed out. Each time a prime factor is found, the original number is replaced by the new quotient thus reducing the size of the number and speeding up the search for new prime factors. The algorithm must then test the new quotient for the same prime factor since repeated prime factors can occur. Once the test fails, the algorithm tests for divisibility by the next odd number. The process halts when the divisor exceeds the quotient. The dividend is then printed out as the final prime factor. Note that not all consecutive odd numbers will be primes. For example, 9 is not prime; however, since all prime factors of 3 have already been removed from the number, the odd number 9 will not appear as a factor. Of course this slows down the process of finding remaining prime factors since 9, 15, 21, 27, etc will be tested unnecessarily.

"Primes" adapts the algorithm to the structure of COMAL and uses repeated calls of the procedure pr'factors. My first attempt at implementing the algorithm involved recursive calls of the procedure. This worked fine for numbers which factored, but promptly blew up with an out of memory error for a large prime number. It was an excellent lesson of the dangers of recursive calls of a procedure.

"Primes1" is a literal translation of the original algorithm into COMAL using four GOTO's. This was done to determine which program was more efficient (see chart of run times at the end of this article).

In "primes2" the original algorithm is improved by adding a conditional statement which eliminates odd divisors which are divisible by 3. Thus 9, 15, 21, 27, etc are skipped.

There still remains odd factors which are divisible by 5, 7, 11, etc. The ideal would be to use only the set of prime factors. This set would have to be generated and read into the program from an external data file. The algorithm requires that the set of prime factors be numbers less than sqr(999999999) or 31622. The integral log formula for approximating the number of primes in the interval 1 to 31622 gives an answer of about 3433 primes.

Writing a program to speed up the process of factoring a number into its primes is now dependent on finding a way to generate the 3400 primes which will serve as possible divisors. The method of the Sieve of Eratosthenes is reasonably efficient, except that it can be used only for primes less than about 15,000 (see "sieve"). It requires an integer array which takes up almost all the computer memory (on a C64) when dimensioned up to 15,000. Further since the sieve algorithm is such that the array cannot be partitioned, this means that the primes from 15,000 to 31,622 must be generated by other means. Program "upper" does this by using primes from 2 through 179 as divisors for all odd numbers in the interval 15000-31622. Running time for the program is over 35 minutes (on a C64). The program "sieve" writes the first group of primes to the sequential file, "primes.dat", while program "upper" appends the second group of primes to that file (ultimately totals 3403 primes).

Finally, "primes3" reads in the sequential file of primes for use as potential divisors. This results in the most efficient program.

The largest prime less than 999,999,999 is 999,999,937. The worst case composite: 998,812,807.

To test the efficiency of the various programs, the worst case prime and composite numbers were selected. The largest prime less than 999,999,999 is **999,999,937**. The worst case composite is **998,812,807** which factors into two nearly equal primes: **31601** and **31607**. The run times each of the programs, run on Amiga, IBM and C64, are included in the chart at the end of this article.

The GOTO version ("primes") outperformed the structured version ("primes1") because unconditional

branches are less time consuming than conditional branches. Eliminating divisors which are multiples of 3 saved some time in "primes2". My disk drive loads the prime factor data file in 1 minute (far less on IBM and Amiga). Once loaded, many numbers can be factored at surprising speed. Remember, the above table represents the worst case. Most composite numbers are factored into primes in a matter of seconds. A number is identified as prime in the program if the only factor printed out is the number itself.

Try your telephone and social security numbers to see if they are prime and, if not, what their prime factors are. Can you find the second largest prime?

Programs "sieve" and "upper" are a two program set that creates the file "primes.dat". You only need them if you wish to create a new file on another disk. (*Or if you do not have Today Disk #25*).

To get a list of the first 3403 primes, printout the sequential file, "primes.dat".

A more efficient sieve algorithm, which differs from the classical one, can be found in *COMAL Today #13* on page 36. However, unlike the classical algorithm, it is not at all clear why it works! Generally I avoid using algorithms I can't explain. This algorithm generates twice the number of primes using the same amount of memory as the classical one and is twice as fast. Unfortunately it still does not generate enough primes to factor the largest natural numbers COMAL or BASIC are capable of handling.

References:

Prime Factorization, Steve Kortendick, *COMAL Today #13*, page 75
1000 Primes Revisited, *COMAL Today #13*, page 36.

Program Notes

These programs will run on all COMALs, if they have enough available memory. AmigaCOMAL can run them with its memory set at 64K. However, since AmigaCOMAL has three types of integers, the "sieve" program integer array should use sieve%() rather than sieve#(). The # type integer is too large and uses up more memory. You may use it, but then you then should set AmigaCOMAL's memory size to at least 96K.

As you are aware, COMAL can time how long a program takes to run. All COMALs except C64 use timer to count seconds. C64 uses time to count jiffies (1/60th of a second). Depending on your computer, use these lines to set and read the timer:

```
TIME 0 // C64
PRINT USING "Time: ###.# secs.": TIME/60
```

or

```
TIMER 0 // IBM and AMIGA
PRINT USING "Time: ###.# secs.": TIMER
```

Also, IBM and Amiga have an easier way to read in values for every element in an array. For example, primes3 can replace 5 lines with this:

```
READ FILE 2: p#()
```

Sieve can use this:

```
sieve#():=1
```

Upper Primes can use this:

```
READ d()
```

Of course, these are just short cuts for Amiga and IBM. They can use the longer methods too! It is your choice.

SIEVE WRITER

```
// Using the sieve method, primes less than 15,000
// are generated and stored in data file: primes.dat
// Program by Bill Inhelder (program 1 of 2)
TIME 0 // C64
//TIMER 0 // Amiga / IBM
PAGE
PRINT "Working..."
DIM sieve#(15000)
FOR i:=1 TO 15000 DO sieve#(i):=1 // *see shortcut*
k:=2
WHILE k<SQR(15000) DO
  FOR i:=2*k TO 15000 STEP k DO sieve#(i):=0
  k:+1
ENDWHILE
count:=1
OPEN FILE 2,"primes.dat",WRITE
FOR i#:=2 TO 15000 DO
  IF sieve#(i#)=1 THEN
    WRITE FILE 2: i#
  ENDIF
ENDFOR i#
CLOSE FILE 2
PRINT USING "Time: ###.# secs.": TIME/60 // C64
//PRINT USING "Time: ###.# secs.": TIMER // Amiga / IBM
```

UPPER PRIMES WRITER (run sieve first)

```
// Using primes 2 through 179, primes from 15001 to 31622
// are generated and appended to data file: primes.dat
// Program by Bill Inhelder (program 2 of 2)
TIME 0 // C64
//TIMER 0 // Amiga / IBM
PAGE
DIM d(40), p#(1650)
count:=1
FOR i:=1 TO 40 DO READ d(i) // *see shortcut*
PRINT AT 12,2: "Calculating Primes From 15000 to 31643"
FOR i:=15001 TO 31643 STEP 2 DO
  finish:=FALSE
```

```
  j:=1
  k:=0
  WHILE NOT finish DO
    pr'factors
  ENDWHILE
ENDFOR i
PRINT AT 14,9: "Writing Primes To File"
OPEN FILE 2,"primes.dat",APPEND
FOR i:=1 TO 1649 DO WRITE FILE 2: p#(i)
CLOSE FILE 2
PRINT AT 16,12: "Writing Completed"
PRINT USING "Time: ####.# secs.": TIME/60 // C64
//PRINT USING "Time: ####.# secs.": TIMER // Amiga / IBM
//
DATA 3,5,7,11,13,17,19,23,29,31,37,41,43,47,53,59
DATA 61,67,71,73,79,83,89,97,101,103,107,109,113
DATA 127,131,137,139,149,151,157,163,167,173,179
//
PROC pr'factors
  q:=i DIV d(j)
  IF q=0 THEN
    finish:=TRUE
  ELSE
    r:=i MOD d(j)
    IF k=1 AND d(j)>q THEN
      p#(count):=i
      count:+1
      finish:=TRUE
    ELSE
      IF r<>0 AND d(j)<i THEN
        k:=1
        j:+1
      ELSE
        finish:=TRUE
      ENDIF
    ENDIF
  ENDIF
ENDPROC pr'factors
```

PRIMES (original)

```
// primes - including GOTO's
PAGE // program by Bill Inhelder
branch1:
PRINT "Type in a whole number >=2 and less"
INPUT "than 999999999:": n
TIME 0 // C64
//TIMER 0 // Amiga / IBM
k:=0; d:=1
branch2:
d:+1
IF d>3 THEN d:+1
branch3:
q:=n DIV d
IF q=0 THEN
  PRINT
  PRINT USING "Time: ###.# secs.": TIME/60 // C64
  //PRINT USING "Time: ###.# secs.": TIMER // Amiga / IBM
  GOTO branch1
ENDIF
r:=n MOD d
IF k=1 AND d>q THEN
  PRINT n
  PRINT USING "Time: ###.# secs.": TIME/60 // C64
  //PRINT USING "Time: ###.# secs.": TIMER // Amiga / IBM
  GOTO branch1
ENDIF
IF r<>0 AND d<n THEN
  k:=1
  GOTO branch2
ENDIF
PRINT d;
n:=q; k:=0
GOTO branch3
```

PRIMES1 (adapted to COMAL structures)

```
// primes1 by Bill Inhelder
PAGE
again:=TRUE
WHILE again DO
  finish:=FALSE
  REPEAT
    PRINT "Type in a whole number >=2 and less"
    INPUT "than 999999999:": n
  UNTIL n>=2 AND n<999999999
  TIME 0 // C64
  // TIMER 0 // Amiga / IBM
  k:=0; d:=2
  // set divisor initially to 2
  WHILE NOT finish DO
    pr'factors
  ENDWHILE
  PRINT USING "Time: ###.# secs.": TIME/60 // C64
  //PRINT USING "Time: ###.# secs.": TIMER // Amiga / IBM
ENDWHILE
//
PROC pr'factors
  q:=n DIV d
  // divides number by divisor giving quotient as integer
  IF q=0 THEN
    PRINT
    // ends print line after factors have been printed out
    finish:=TRUE
  ELSE
    r:=n MOD d
    IF k=1 AND d>q THEN
      // condition for final or only prime factor
      PRINT n
      finish:=TRUE
    ELSE
      IF r<>0 AND d<n THEN
        // divisor is not a factor & divisor is smaller
        // than dividend
        k:=1
        d:+1
        IF d>3 THEN d:+1
        //produces consecutive odd divisors when divisor>3
      ELSE
        PRINT d;
        // remainder is zero; prime factor is printed out
        n:=q
        // replaces dividend with new quotient
        k:=0
        // permits divisibility check by repeated factor
      ENDIF
    ENDIF
  ENDIF
ENDPROC pr'factors
```

PRIMES2 (improved version)

```
// primes2 - Improved version of prime'factors made by
// eliminating trial divisors which are multiples of 3
PAGE // program by Bill Inhelder
again:=TRUE
WHILE again DO
```

```
  finish:=FALSE
  REPEAT
    PRINT "Type in a whole number >=2 and less"
    INPUT "than 999999999:": n
  UNTIL n>=2 AND n<999999999
  TIME 0 // C64
  // TIMER 0 // Amiga / IBM
  k:=0; d:=2
  WHILE NOT finish DO
    pr'factors
  ENDWHILE
  PRINT USING "Time: ###.# secs.": TIME/60 // C64
  //PRINT USING "Time: ###.# secs.": TIMER // Amiga / IBM
ENDWHILE
//
PROC pr'factors
  q:=n DIV d
  IF q=0 THEN
    PRINT
    finish:=TRUE
  ELSE
    r:=n MOD d
    IF k=1 AND d>q THEN
      PRINT n
      finish:=TRUE
    ELSE
      IF r<>0 AND d<n THEN
        k:=1
        d:+1
        IF d>3 THEN
          d:+1
          IF d MOD 3=0 THEN d:+2
        ENDIF
      ELSE
        PRINT d;
        n:=q
        k:=0
      ENDIF
    ENDIF
  ENDIF
ENDPROC pr'factors
```

PRIMES3 (final version)

```
// primes3 - Fastest version - requires file "primes.dat"
// trial divisors are a set of primes (read from the file)
// required to factor into primes or determine whether
// any number less than 999,999,999 is prime
PAGE // program by Bill Inhelder
DIM p#(3403)
PRINT AT 12,5: "Loading Prime Number Data File"
OPEN FILE 2,"primes.dat",READ
j:=1 // *see shortcut* *these 5 lines*
REPEAT
  READ FILE 2: p#(j)
  j:+1
UNTIL EOF(2) // *shortcut replaces to here*
CLOSE FILE 2
PAGE
count:=j-1
again:=TRUE
WHILE again DO
  finish:=FALSE
  REPEAT
    PRINT "Type in a whole number >=2 and less"
    INPUT "than 999999999:": n
  UNTIL n>=2 AND n<999999999
  TIME 0 // C64
  // TIMER 0 // Amiga / IBM
  k:=0; j:=1
  WHILE NOT finish DO
    pr'factors
  ENDWHILE
  PRINT USING "Time: ###.# secs.": TIME/60 // C64
  //PRINT USING "Time: ###.# secs.": TIMER // Amiga / IBM
ENDWHILE
//
PROC pr'factors
  q:=n DIV p#(j)
  IF q=0 THEN
    PRINT
    finish:=TRUE
  ELSE
    r:=n MOD p#(j)
    IF k=1 AND p#(j)>q THEN
      PRINT n
      finish:=TRUE
    ELSE
      IF r<>0 AND p#(j)<n THEN
        j:+1
        k:=1
      ELSE
        PRINT p#(j);
        n:=q
        k:=0
      ENDIF
    ENDIF
  ENDIF
ENDPROC pr'factors
```

RUN TIMES

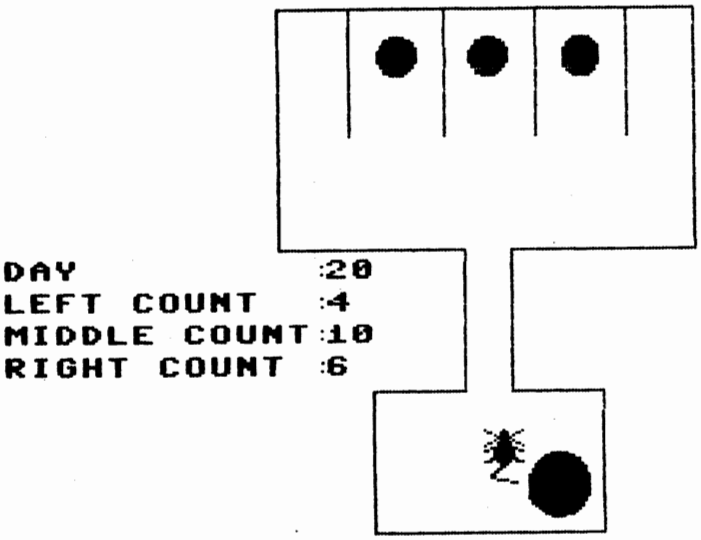
```
Sieve-Writer
A2  43.7
I3  81.2
I2 110.5
C2 243.3

Upper-Writer
A2   278.6
I3   n/a did not work
I2  1104.0
C2  2177.0

Primes (all 4 versions)
A2-0  36.5
A2-1  44.1
A2-2  33.0
A2-3  10.1

I3-0 126.4
I3-1 131.2
I3-2 128.1
I3-3  32.3

I2-0 165.0
I2-1 179.6
I2-2 163.2
I2-3  43.1

C2-0 328.2
C2-1 354.0
C2-2 311.1
C2-3  81.5
```

Base model Amiga 500 and IBM PC clone used for the tests.
A2=AmigaCOMAL // I2=IBM 2.2 // I3=IBM 3.0 // C2=C64 2.0
-0 =primes // -1 =primes1 // -2 =primes2 // -3 =primes3 ■

Learning Model

by Bill Inhelder

Psychologists tell us that when learning occurs it often manifests itself in a modification of behavior. Positive reinforcement can strengthen learned behavior while negative reinforcement can undo learned behavior and lead to alternative behavior. The program learning'model is a graphic simulation of a rat's ability to learn and to modify its behavior. A rat is located in a compartment containing only water. Once a day the door to a corridor opens leading to 3 feeding stalls each of which contains food. When the rat enters a stall to feed, the doors to the other two stalls close. In this way the rat receives a one-day supply of food.



The program graphically illustrates the feeding habit of a randomly selected rat over a 20 day period. Data is kept on the frequency with which the stalls are used. Following the initial observation period, the program allows the user to direct the placement of food into only one stall. The rat's task is to find the food before starvation causes death. This description belies the complexity of the decision making process. To illustrate the difficulty, let us consider the problem from a human standpoint. Suppose a prisoner is locked in a room with only water. There are 3 buttons on a wall and a slot which dispenses food. Each day the prisoner presses one of the buttons and receives a ration of food for that day. Once a button is pressed for that day the other buttons are inoperative. After some experimenting the prisoner discovers that it does not matter which button is pressed to obtain food for the day. No one button produces a better quality or choice of food.

Suppose the prisoner is more likely to press the right hand button than any of the others. Now one day he presses the right hand button and receives no food. Pressing the other buttons does no good. He figures that someone simply forgot to put the food in the compartment. Consequently he presses the right hand button the next day and still receives no food. Hunger and possibly panic make him reason that one or both the other buttons will provide food. On the third day he presses the middle button and still receives no food. Logic now tells him that, if there is any food at all, the left hand button will produce food. His reasoning will be correct provided the food is not moved from the left compartment (where it was for 3 days) back to the right compartment. Nothing is certain when a three-fold choice exists and there is an arbitrary positioning of the food.

The simulation of a rat's reasoning ability should not necessarily duplicate human reasoning ability. What sort of algorithm might simulate a rat's ability to solve the task of obtaining food? The algorithm should not produce an absolute either/or logical action but rather one which is probability based. We need an algorithm where decisions are based upon the probability of a random number falling within a specified interval. Specifically consider the interval of real numbers between 0 and 1. Select two random numbers in that interval and designate the smaller, the lower bound, and the larger, the upper bound. Suppose the lower bound is .3 and the upper bound .9. If a random number between 0 and 1 is selected, there is greater probability that it will lie in the middle interval rather than the right hand interval. This rat will select the middle stall for food more often than the left stall and much more often than the right stall. By moving the lower and upper bounds we can influence the rat's behavior in a probabilistic sense.

The algorithm used in the program to increase or decrease the bounds makes use of the rat's intelligence (rat I.Q.). Two iterative equations accomplish the task of increasing and decreasing the bounds:

```
newbound:=oldbound*(1-smart)+smart
newbound:=oldbound*(1-smart)
```

The first equation increases the bound at a decreasing rate permitting the upper bound to approach but not exceed 1. The second equation decreases the bound at a decreasing rate permitting the lower bound to approach but not be less than 0. The rat's intelligence is assigned randomly and varies from .15 to .45 representing R.I.Qs ranging from 70 to 130. To make the algorithm function properly, upper and lower bounds must be swapped when the lower bound exceeds the upper bound. In addition the rat must be provided with a memory which recalls the previous result of its action. Rats with low R.I.Qs will take longer to find the food and may die of starvation before succeeding.

Learning Model (continued)

If the rat is right oriented select the left or middle stalls for food and keep it there until the rat finds it consistently. The more often the rat receives positive reinforcement (food), the more consistently will the rat go to that stall. Even so, occasionally the rat will revert to an old (incorrect) habit. After the rat has learned the location of the food, change it to another location and keep it there until it finds it consistently. Finally move the food around from stall to stall each day to see if you can exceed the frustration tolerance of the rat or starve it to death. In either case, if you succeed, the program will halt. Press Q to exit program. If you wish, rerun the program for a different rat.

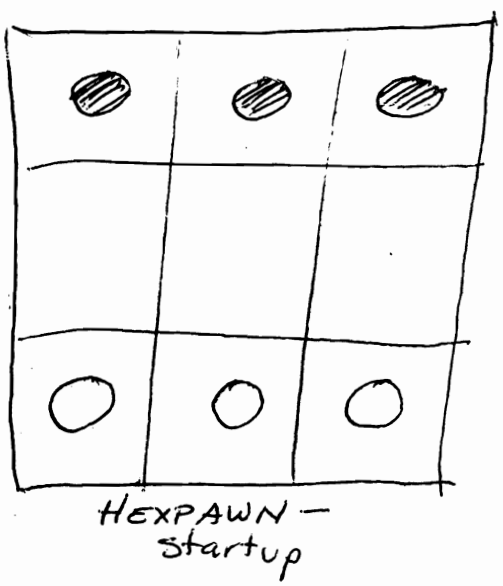
Those who are interested in observing the changes in the bounds with respect to the placement of food insert

```
PRINT lo;hi;stall$
```

before the ENDLOOP statement in the procedure path'selection. The bounds and food location will appear on the textscreen after exiting the program.

Reference:

Quick Sprites, Sol Katz, *COMAL Today #13*, page 18.



Challenge

I have a programming challenge for those interested in Learning Machines. It is one thing to write a program that has instructions on what to do in response to all possible situations. It is another thing to write a program that learns; that will not do what it has been told to do, but what it has learned to do.

Martin Gardner designed the game HEXPAWN as a challenge for a simple learning program. He correctly assumed that most readers would not wish to construct a learning machine that involved hundreds of possibilities. HEXPAWN has only 24 possible situations. The game is trivial, but does give you an easy basis for a learning program.

The rules of the game are simple. The game board is a 3 by 3 checkerboard. Each side has three pieces (white for one team, black for the other). These pieces (called pawns) are placed on the players end row at the start of the game, leaving the middle row blank.

There are only two possible moves:

- move one of your pawns forward one square if that square is empty.
- capture opponent pawn by moving onto its square diagonally to the left or to the right. The captured pawn is removed from the board.

The moves are similar to those of a pawn in chess.

There are three ways to win:

- Advance one of your pawns to the third row.
- Capture all your opponents' pawns.
- Put your opponent into a position where there is no possible move.

Players take turns, moving one pawn at a time. A draw is not possible.

Construct your program so that it always makes the second move (you play first). This makes the program easier for you.

You now have enough information to write the program. However, additional explanations complete with good illustrations are available in the book *The Unexpected Hanging and Other Mathematical Diversions* by Martin Gardner beginning on page 90. This is a Fireside book published by Simon and Schuster.

Send in your program entries now. More hints next issue (don't want to spoil your fun). ■

Don't Touch That Filename!!

by Len Lindsay

Don't you hate it when someone changes the name of your program on the disk (I know, we do it here to submissions). Well, I will let the secret out.

AmigaCOMAL is a next generation COMAL. It includes many new features such as two built-in keywords: **argnum** and **argarray$**. These give you information about how the program was started and any parameters passed to it. Another new feature allows you to write packages in COMAL itself.

So, I wrote a package that you should find interesting. I call it proginfo. It adds three new functions to AmigaCOMAL:

```
ProgramName$
ProgramDir$
ProgramDevice$
```

These will tell you three things about the program running: it's filename, the directory it was in, and the device it was on.

This is generally useful only for a compiled program. Run the package from AmigaCOMAL and you will only find out where AmigaCOMAL was when it was started.

Two Tips

After writing this package, I'd like to point out two items for those who will be involved in similar projects. This may seem like plain common sense to you, but it had me going in circles.

AmigaCOMAL checks to see if a package is already "loaded" when you issue a USE command. If so, it just uses that, and does not reload the package. This is great, since it saves disk access if you use a package over and over. However, it is a hinderance when developing a package. For example, I created the package and a quick little program to test it. I found a problem, so I LOADed the package, modified it, then SAVEd the package with the same name so I could run my test program unchanged. I ran the test program. Hmmmm. The problem was still there. I tried several other "fixes". None worked. Then it occurred to me that I was updating the disk package, but not the one AmigaCOMAL was using ... it kept using the original since it was "loaded" already.

Solution: issue a DISCARD command before you test your package revisions.

Next I found that argarray$(0) considers the current directory the **ROOT** when a program is started (except if you give a full device & directory when starting it from the CLI). Therefore, using argarray$(0) to find the program device and directory would not always work. I had to modify my package to find the program device and directory from the contents of **DIR$** when a full path was not returned by argarray$(0). If the package does not find a ":" in the name, it assumes that it is not a full path. Thus my functions to return the device and directory are in two parts, analyzing one of two possible path strings.

Silly Test Program

I wrote a sample silly program that can be used to test out the package. It expects that it's file name will be SeeCOMAL. Try renaming it ... then run it. Also note that the program checks for certain tooltypes to be set if it was started by clicking on it's icon in WorkBench. In this example, it checks if they are COMAL Users Group's name and address. To pass the test, they must be exactly as specified in the three DATA statements (*an interesting way to make sure your copyright notice stays with the program in its icon tooltypes*).

The program, icon and package are on Amiga Today Disk #25.

The program, icon (with tooltypes set) and package are on *Amiga Today Disk #25*. For those who don't get that disk, here is a step by step procedure to follow to see the program and package at work:

1) Type in the sample program and save it on disk:

```
SAVE "SeeCOMAL"
```

   Note that AmigaCOMAL will create a matching icon for the COMAL program. This is not the icon we will be modifying later!

2) Type in the package (it is listed after the program). Save it on disk:

```
SAVE "ProgInfo.pck"
```

3) Now you can test your program. The results will not be as interesting as after you compile it, but you will find out if all is running OK:

```
LOAD "SeeCOMAL"
RUN
```

4) Once your program is running OK, you are ready to compile it (this step requires the optional compiler available as part of the AmigaCOMAL Developers Option). Compile the

program SeeCOMAL (see your documentation that came with the compiler). Note that the compiler will create a matching icon for the compiled program. **This is the icon we will be modifying next!**

5) Go into WorkBench. Click on the disk you just stored the program on. You should see the icon for the program, unless you have it in a subdirectory. In that case you must have drawer icons for the subdirectories leading to the compiled COMAL program (or just copy it to the root of the disk).

6) Click once on the programs icon. This selects it. Then hold down the right button on the mouse. This activates the WorkBench menus. Slide over to the left, and then down to choose INFO from the menu (highlight INFO then let go of the mouse button). The INFO screen should come up for the program.

7) Put in three tooltypes. Click on the ADD gadget to add them. Here are the three lines you should add as tooltypes:

   COMAL Users Group USA Ltd
   5501 Groveland Terrace
   Madison, WI 53716

8) Click on the SAVE gadget. You now are ready for the test.

9) Double click on the icon for the program. It should start up and give you this report (the info provided in the report will of course be based on the filename you used, it's subdirectory and tooltypes set):

Program name is test-proginfo
Hey, you changed it!

It is in subdirectory SeeComalDir/
on device ComalToday25:

The program was started from Workbench
with **no tooltypes.**

*Hey! Who deleted my tooltypes!?@^*

This message was brought to you by
a COMAL program from Captain COMAL!

Press a key or click your mouse now...
«click right mouse button»

Test Program (to be compiled first)

```
// seecomal or test-proginfo by Len Lindsay
USE PROGINFO // use the package named proginfo
page // clear the screen
DIM mytool$(3) OF 40 // three tool type names
READ mytool$() // read them all in at once
DATA "COMAL Users Group USA Ltd"
DATA "5501 Groveland Terrace"
DATA "Madison, WI 53716"
PRINT AT 2,1: "Program name is";programname$
compare(programname$,"SeeCOMAL")
CURSOR 5,1 // ready for next print
IF programdir$="" THEN
  PRINT "It is in the root directory"
ELSE
  PRINT "It is in subdirectory";programdir$
ENDIF
IF programdevice$="" THEN
  PRINT "on your current device (",dir$,")."
ELSE
  PRINT "on device";programdevice$
ENDIF
CURSOR 9,1 // ready for next print
PRINT "The program was started from";
PRINT chr$(18),argarray$(-1),chr$(18)
IF argarray$(-1)="CLI" THEN  // chr$(18)=underline
  IF argnum<1 THEN  //tells how many parms passed
    PRINT "with no parameters passed."
  ELSE  // chr$(20)=bold // only one parm from CLI
    PRINT "with this as the parameter passed:"
    PRINT chr$(20);argarray$(1),chr$(20)
  ENDIF
ELSE
  IF argnum<1 THEN //argnum = how many tooltypes set
    PRINT "with";chr$(20),"no tooltypes.",chr$(20)
    PRINT  // chr$(19)=italic
    PRINT chr$(19),"Hey!"
    PRINT "Who deleted my tooltypes!?@^",chr$(19)
  ELSE
    PRINT "with these tooltypes set:"
    FOR x:=1 TO argnum DO
      PRINT chr$(20);argarray$(x);chr$(20)
      compare(argarray$(x),mytool$(x))
      PRINT  // end of line
    ENDFOR x
  ENDIF
ENDIF
PRINT
PRINT chr$(16);chr$(19), // reverse field italic
PRINT "This message was brought to you by "
PRINT " a COMAL program from Captain COMAL!",
PRINT chr$(19),chr$(16) // toggle them back to normal
PRINT
PRINT "Press a key or click your mouse now..."
WAIT  // wait for keypress or mouse click

PROC compare(supposed'to'be$,is'now$) CLOSED
  IF supposed'to'be$<>is'now$ THEN
    PRINT chr$(16);"Hey, you changed it!";chr$(16),
  ENDIF  // chr$(16)=reverse
ENDPROC compare
```

Next comes the listing of the package. This package is written in COMAL, so you can type it in yourself! Enter it just like any program. However, when you save it, end the file name with .pck and viola, you have created a package!

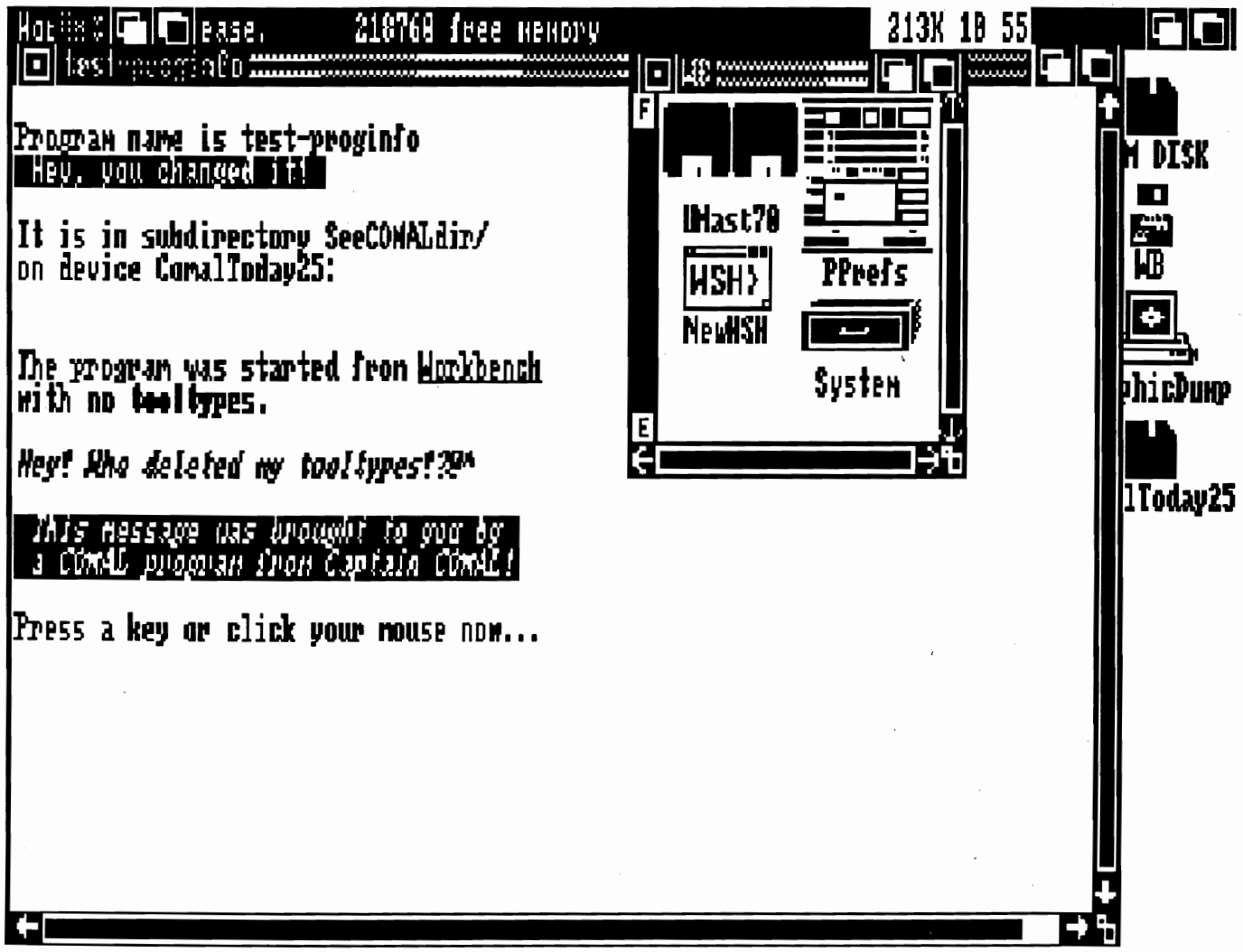
PACKAGE: ProgInfo

```
EXPORT programname$ // name of program file
EXPORT programdir$ // name of directory it was in
EXPORT programdevice$ // name of device it was on
```

Don't Touch That Filename!! (continued)

```
FUNC programname$ CLOSED
  p$:=argarray$(0) //full name: device:directory/name
  // next use the IN operator to get a substring
  p$:=p$((":" IN p$)+1:)
  // next check the subdirectories
  WHILE "/" IN p$ DO p$:=p$(("/" IN p$)+1:)
  RETURN p$
ENDFUNC programname$

FUNC programdir$ CLOSED
  IF ":" IN argarray$(0) THEN // a full path
    RETURN dirdir$(argarray$(0))
  ELSE
    RETURN dirdir$(dir$) // use dir$ for path
  ENDIF
ENDFUNC programdir$

FUNC dirdir$(p$) CLOSED // this func is NOT exported
  TRAP // in case there is no ":" in p$
    p$:=p$((":" IN p$)+1:) // substring with the IN search
  HANDLER
    NULL // don't change p$
  ENDTRAP
  d$:="" // init to null in case no directories
  WHILE "/" IN p$ DO  // as long as "/" is in the name...
    d$:+p$(1:("/" IN p$)) // concatenate the string
    p$:=p$(("/" IN p$)+1:) // removes part of p$
  ENDWHILE
  RETURN d$
ENDFUNC dirdir$

FUNC programdevice$ CLOSED
  IF ":" IN argarray$(0) THEN // a full path
    RETURN devicedevice$(argarray$(0))
  ELSE
    RETURN devicedevice$(dir$) // use dir$ for path
  ENDIF
ENDFUNC programdevice$

FUNC devicedevice$(p$) CLOSED // this func is NOT exported
  IF ":" IN p$ THEN  // substring IN search
    RETURN p$(1:(":" IN p$)) // substring with IN search
  ELSE
    RETURN ""
  ENDIF
ENDFUNC devicedevice$
```

Note: this package and program was on PLink for AmigaCOMAL users to download over a month before publication here. Ah, the benefits of instant access on-line support. ■



Power To The People

by Jesse Knight

[*Just a few days after Jesse received AmigaCOMAL he had solved one of the annoying quirks ... when a program ends, the execute screen stays in front. The command screen is not returned to the front. If you would like the command screen to automatically pop to the front, this package will do it for you.*]

This small package utilizes the **signal** routine. As you can see in the listing, it only needs one line! If it senses a signal number 7, 8 or 9 it calls the commandtofront procedure, which pushes the command window to the front. Section 4.2 of your manual explains the meanings of the signal values. Here are the meanings for the three we are catching:

7 - Program end by program error.
8 - Program end.
9 - Program stop that may be CONtinued.

It is easy to set up this package. Just use AUTO mode to type it in as if it were a program. Then use the SAVE command to store it on disk as a package. It is a good idea to keep it in the **packages** subdirectory, so this command should do the trick:

```
SAVE "/packages/CFront.pck"
```

If you have COMAL installed on a hard drive, you will need the correct path to the packages directory. One sure way to store it properly is to change directories so that **packages** is the current directory with a command similar to:

```
CD "/packages"
```

Then you can just use a normal SAVE command with the .pck filename extension:

```
SAVE "CFront.pck"
```

This gives a package with the name **CFront**. It could just as easily have been called **CommandToFront**, but **CFront** is much less typing.

Now, just issue a USE command to start it up:

```
USE CFront
```

If you would like it to start each time you start COMAL, add a tooltype to the AmigaCOMAL icon:

```
USE CFront
```

Double click on the AmigaCOMAL icon to start COMAL with CFront active. You can see how AmigaCOMAL gives you power to change even its operating environment! Power to the people.

Since this is a package, it may at times become "discarded". In that case just issue the USE command again.

```
USE SYSTEM
USE INTUITION_LIBRARY
EXPORT commandtofront
GLOBAL pckwindowtofront
GLOBAL comalstruct@
GLOBAL commandtofront

PROC commandtofront CLOSED
  pckwindowtofront(comalstruct@.command_io@.window#)
ENDPROC commandtofront

PROC signal(s) CLOSED
  IF s>=7 AND s<=9 THEN commandtofront
ENDPROC signal
```

SYSTEM Fix

[*Jesse also found the following problem ... which is easily corrected.*]

Section 4.4.1.2 of the manual lists the **io_struct@** record structure. Appendix D.1 also lists this structure. However, Appendix D.1 lists nine more items at the end of the record definition! This is the correct version. However, looking at the **SYSTEM** package on the original AmigaCOMAL disk we find the **io_struct@** record structure is also missing those fields.

You can see the power of AmigaCOMAL when I tell you how easy it is to correct the **SYSTEM** package. Just add the missing lines and save it back to disk! Do this:

```
CD "/packages" //use path to your packages directory
LOAD "system.pck"
LIST 90-160
0090 RECORD io_struct@
0100   FIELD screen#
0110   FIELD screentype%, screendepth%, screenwidth%,
       screenheight% // wrap line
0120   FIELD window#
0130   FIELD windowdepth%, charno%, lineno%
0140   FIELD gzzxoff%, gzzyoff%
0150   FIELD windowwidth%, windowheight%
0160 ENDRECORD io_struct@
AUTO 151,1
0151 field fontid#, fontheight%, fontwidth%, fontbase%
0152 field virtual#
0153 cursor!, softstyle!
0154 menuhd#
0155 menubytes#
0156 «Esc»                <===stop AUTO mode
SAVE "system.pck"
```

That is all there is to it. The **SYSTEM** package is written in COMAL, and it is easy to modify COMAL coded packages. Note that only the earliest AmigaCOMAL disks had the missing fields. The master disk was corrected immediately. ■

RECORD Structure

by David Stidolph

AmigaCOMAL not only implements Common COMAL, but extends it with many new features. This article focuses on one of those new features: **RECORDS**. A record is a set of data elements tied together under the same name. An example of this is a simple data base to keep track of a persons name, address and telephone number. In any other COMAL you might use the following variables:

```
DIM last'name$ OF 20
DIM first'name$ OF 15
DIM inital$ OF 1
DIM address$ OF 25
DIM city$ OF 20
DIM state$ OF 2
DIM zip$ OF 5
DIM phone'num$ OF 15
```

This would work, but to pass a persons information to a procedure would require eight parameters -- a lot of typing at the very least. In AmigaCOMAL you could group all these variables into one **record**. For example:

```
RECORD type'person@
  FIELD last'name$ OF 20
  FIELD first'name$ OF 15
  FIELD inital$ OF 1
  FIELD address$ OF 25
  FIELD city$ OF 20
  FIELD state$ OF 2
  FIELD zip$ OF 5
  FIELD phone'num$ OF 15
ENDRECORD type'person@
```

This may be a bit more typing initially, but let's suppose you need a procedure to enter information about a new person, but want to pass the variables as parameters because you want several different persons data in memory at once (the old person, the new person and matching data for comparisons). Under most COMAL's you would have a procedure declaration like this:

```
PROC input'data(REF ln$,REF fn$,REF in$,REF ad$,REF
ci$,REF st$,REF zip$,REF ph$) //wrap line
```

Besides shortening the names so they would fit on a line, you would have to keep constant track of not only the names of the variables, but **the order to pass them** to the procedure. If you need several different versions of the same data, the names would start to get very long (like **old'last'name$**).

With AmigaCOMAL you can group all the different variables (called FIELDS) into a **RECORD** structure and pass it to the procedure like this:

```
PROC input'data(REF person@)
```

Notice that you don't have to remember the order of parameters. To refer to any one of the variables kept in **person@** you use the following method:

```
person@.last'name$
```

person@, as a prefix to the variable informs COMAL that this is a record variable, and specifys the specific record (person@). After that comes the actual variable you want to access. In order to use **person@** you must first define it (like DIMmensioning a string):

```
DIM person@ OF type'person@
```

This tells COMAL that you want a variable record named person@ and to look at the definition type'person@ for the different type of variables and their names. Another advantage is that you could create several different records based on type'person@ and make your program both shorter and more readable:

```
DIM person@ OF type'person@
DIM old'person@ OF type'person@
DIM new'person@ OF type'person@
```

All of these records have the same named variables within them, but each of those variables could hold a different value (person@.last'name$ is different from old'person@.last'name$).

Besides making parameter passing easier, records can be assigned the values of other records if they are of the same type. For example, you may wish to make a new person the current one, but first change the current one to be the old'person:

```
old'person@ := person@
person@ := new'person@
```

Records can really help your programming, and on the Amiga they are absolutely necessary.

```
// by David Stidolph for AmigaCOMAL only
RECORD type'person@
  FIELD valid!
  FIELD last'name$ OF 25
  FIELD first'name$ OF 10
  FIELD inital$ OF 1
  FIELD sex$ OF 6
  FIELD married
  FIELD num'of'children
  FIELD phone$ OF 15
ENDRECORD type'person@

DIM person@ OF type'person@
DIM choice$ OF 1, match$ OF 80
init'program
REPEAT
  menu(choice$)
  do'menu(choice$)
UNTIL choice$ IN "4qQ"
quit
```

RECORD Structure (continued)

```
PROC init'program
  max'records:=20
  TRAP
    OPEN FILE 1,"demo.rnd",RANDOM varsize(type'person@)
  HANDLER
    CREATE "demo.rnd",max'records,varsize(type'person@)
    OPEN FILE 1,"demo.rnd",RANDOM varsize(type'person@)
    // Amiga COMAL automatically initializes variables
    // to null values, so we don't have to.
    FOR record'num:=1 TO max'records DO
      WRITE FILE 1,record'num: person@
    ENDFOR record'num
  ENDTRAP
ENDPROC init'program

PROC menu(REF choice$) CLOSED
  DIM keystroke$ OF 1
  page
  PRINT "Main Menu"
  PRINT
  PRINT "1) Add person"
  PRINT "2) Delete person"
  PRINT "3) Find person"
  PRINT "4) Quit program"
  PRINT
  REPEAT
    PRINT "Your choice:";
    choice$:=inkey$
  UNTIL choice$ IN "1234adfqADFQ"
  PRINT
  PRINT
ENDPROC menu

PROC do'menu(choice$)
  CASE choice$ OF
  WHEN "1","a","A"
    input'person(person@)
    record'num:=next'free
    IF record'num=0 THEN
      PRINT "No more records available!"
      press'return
    ELSE
      person@.valid!:=true
      WRITE FILE 1,record'num: person@
    ENDIF
  WHEN "2","d","D"
    FOR record'num:=1 TO max'records DO
      READ FILE 1,record'num: person@
      IF person@.valid! THEN
        display'person(person@)
        IF wants'deleted THEN
          person@.valid!:=false
          WRITE FILE 1,record'num: person@
        ENDIF
      ENDIF
    ENDFOR record'num
  WHEN "3","f","F"
    INPUT "Enter characters to match: ": match$
    FOR record'num:=1 TO max'records DO
      READ FILE 1,record'num: person@
      IF person@.valid! THEN
        IF match$="*" OR match$ IN combine$(person@) THEN
          display'person(person@)
          press'return
        ENDIF
      ENDIF
    ENDFOR record'num
  OTHERWISE
    NULL // ignored
  ENDCASE
ENDPROC do'menu

PROC quit
  CLOSE FILE 2
  page
  END "Done."
ENDPROC quit

PROC display'person(person@)
  page
  PRINT "Name:  ";person@.last'name$,",";
  PRINT person@.first'name$;person@.inital$
  PRINT "Sex:   ";person@.sex$,",";
  IF person@.married THEN
    PRINT "is married";
  ELSE
    PRINT "is not married";
  ENDIF
  PRINT "and has";person@.num'of'children;"children."
  PRINT "Can be reached at:";person@.phone$
  PRINT
ENDPROC display'person

FUNC combine$(person@) CLOSED
  RETURN person@.last'name$+person@.first'name$
ENDFUNC combine$

PROC input'person(REF person@)
  INPUT "Last name: ": person@.last'name$
  INPUT "First name: ": person@.first'name$
  INPUT "Middle inital: ": person@.inital$
  INPUT "Sex: ": person@.sex$
  REPEAT
    INPUT "Married (y/n): ": confirm$
  UNTIL confirm$ IN "yYnN"
  person@.married:=(confirm$ IN "yY")>0
  INPUT "Num of children: ": person@.num'of'children
  INPUT "Phone number: ": person@.phone$
ENDPROC input'person

PROC press'return CLOSED
  PRINT
  PRINT "Press RETURN to continue"
  WHILE key$<>chr$(13) DO NULL
ENDPROC press'return

FUNC next'free CLOSED
  IMPORT type'person@,max'records
  DIM person@ OF type'person@
  FOR rec'num:=1 TO max'records DO
    READ FILE 1,rec'num: person@
    IF NOT person@.valid! THEN RETURN rec'num
  ENDFOR rec'num
  RETURN 0
ENDFUNC next'free

FUNC wants'deleted CLOSED
  DIM keystroke$ OF 1
  PRINT
  PRINT "Do you want to delete this entry? ";
  REPEAT
    keystroke$:=inkey$
    IF NOT keystroke$ IN "yYnN" THEN
      PRINT chr$(7),chr$(25),
    ENDIF
  UNTIL keystroke$ IN "yYnN"
  RETURN keystroke$ IN "yY"
ENDFUNC wants'deleted ■
```

You can get a list of all the routines in a specified package by using the command:

```
LISTPACK «package name» [[TO] file name]
```

Example: To get a printer listing of all the routines in the graphics package you would type:

```
LISTPACK Graphics TO "lp:"
```

When a package is read into RAM from disk it will stay in RAM until all packages are removed by the command:

```
DISCARD
```

4.2 Programming Packages

A package may be written in AmigaCOMAL (COMAL package) or it may be written in assembler, C or another suitable compiler (machine coded package).

In this section we will describe how to develop COMAL coded packages. Developing machine coded packages will be discussed in the Development Manual (a separate, added cost option).

A COMAL coded package is simply a normal AmigaCOMAL program with some EXPORT statements added at the beginning and then saved to disk with the SAVE command, specifying a file name that ends with .pck.

Example: The following package contains only one procedure, rand, which is an improved version of the rnd function in AmigaCOMAL (for further details see BYTE March 1987 page 127).

```
0010  // Random package
0020
0030 EXPORT rand
0040
0050 x:=1; y:=10000; z:=3000 // Seeds
0060
0070 FUNC rand CLOSED
0080   x:=171*(x MOD 177)-2*(x DIV 177) // First generator
0090   y:=172*(y MOD 176)-35*(y DIV 176) // Second generator
0100   z:=170*(z MOD 178)-63*(z DIV 178) // Third generator
0110   temp:=x/30269.0+y/30307.0+z/30323.0 // Combine
0120   RETURN temp-int(temp)
0130 ENDFUNC rand
```

DISK DIRECTORIES

COMMODORE 64

Today Disk 22 Front

```
bootslow
fastboot
ml.sizzle
power driver
hi
menu
 -------------
| power driver |
| system files |
|  are above   |
 -------------
|next are text |
|files read by |
|the menu prog |
 -------------
notes.txt
graphics.txt
sprites.txt
powerkeyword.txt
 -------------
|   programs   |
 -------------
alt'maze.pwr
animal fun
chi-square.pwr
creatormaker.pwr
display bam.pwr
football quiz
image'lines.lst
maze.pwr
multident.pwr
music
unscratch.pwr
walking boots
 -------------
|  data files  |
 -------------
fortress.song
joyful.song
 -------------
| sprite files |
 -------------
imag.26animals
imag.ant
imag.bear
imag.cat
imag.dog
imag.elk
imag.fox
imag.goat
imag.horse
imag.iguana
imag.jackass
imag.kangaroo
imag.lion
imag.monkey
imag.newt
imag.octopus
imag.pig
imag.quail
imag.rooster
imag.squirrel
imag.turkey
imag.urchin
imag.vulture
imag.whale
imag.xenopus
imag.yak
imag.zebra
 -------------
|**attention!**|
 -------------
|all the needed|
| power driver |
|  files are   |
|combined to 1 |
|self-disolving|
|arc file below|
 -------------
|this file may |
|be uploaded to|
| networks and |
| local bbs's  |
 -------------
|after download|
|place a blank |
|formatted disk|
|in the drive &|
|issue the run |
|command:  run |
|it will write |
|the full files|
|for the power |
|driver system |
|onto the disk |
 -------------
|the file is on|
| qlink in our |
|comal section |
 -------------
powerdriver.sda
 -------------
| please don't |
|give copies of|
|this disk out |
 -------------
|copyright 1988|
| comal users  |
|group usa ltd |
|5501 groveland|
| madison, wi  |
|    53716     |
 -------------
```

Today Disk 22 Back

```
hi
 -------------
| 2.0 programs |
 -------------
animal fun
auld lang syne
buffer editor
c128 hi-res cube
chi-square
convertimag-shap
creatormaker
dir designer
image'lines.lst
iterative (blas)
mouse maze
mouse maze'alt
multident
music
partitionaid1581
playscore'rose
reorder dir
sprite creator
walking boots
write'playscore
 -------------
|  data files  |
 -------------
dat.rose
fortress.song
joyful.song
txt.dir help
txt.buffer help
txt.buffer inst
 -------------
|  functions   |
 -------------
func.digits
func.value
 -------------
|sprite images |
| for use with |
|  read file   |
 -------------
imag.26animals
imag.ant
imag.bear
imag.cat
imag.dog
imag.elk
imag.fox
imag.goat
imag.horse
imag.iguana
imag.jackass
imag.kangaroo
imag.lion
imag.monkey
imag.newt
imag.octopus
imag.pig
imag.quail
imag.rooster
imag.squirrel
imag.turkey
imag.urchin
imag.vulture
imag.whale
imag.xenopus
imag.yak
imag.zebra
 -------------
| sprite shape |
|files for use |
|with loadshape|
 -------------
shap.ant
shap.bear
shap.cat
shap.dog
shap.elk
shap.fox
shap.goat
shap.horse
shap.iguana
shap.jackass
shap.kangaroo
shap.lion
shap.monkey
shap.newt
shap.octopus
shap.pig
shap.quail
shap.rooster
shap.squirrel
shap.turkey
shap.urchin
shap.vulture
shap.whale
```

DISK DIRECTORIES

```
shap.xenopus
shap.yak
shap.zebra
 -------------
|please do not |
|copy this disk|
 -------------
|copyright 1988|
| comal users  |
|group usa ltd |
|5501 groveland|
| madison, wi  |
|    53716     |
| 608-222-4432 |
 -------------
```

Today Disk 23 Front

```
bootslow
fastboot
ml.sizzle
power driver
hi
 -------------
| power driver |
|   programs   |
 -------------
bbca color book
ccs color book
computer
cowboy
cryptograms.pwr
dribble
hearts
high'card
tower
 -------------
|  data files  |
 -------------
dat.cryptograms2
A-room'descs.ran
A-seqdata.dat
A-help.txt
 -------------
|  procedure   |
 -------------
prompt.proc
 -------------
|programs that |
|were listed to|
|disk. use the |
|commands:     |
 -------------
|new           |
|enter         |
 -------------
| to retrieve  |
|the programs. |
| the programs |
|will run under|
|both 2.0 cart |
|& power driver|
 -------------
|more lst files|
|on back of the|
|disk for power|
|driver.       |
 -------------
a-h/make'ran.lst
a-h/make'seq.lst
allegan-high.lst
envelope-prt.lst
 -------------
| power driver |
|   utility    |
 -------------
expr-eval.lst
 -------------
|use the next 2|
| files to set |
|screen colors |
|that work with|
|both 2.0 cart |
|& power driver|
 -------------
toplines1-7.lst
textcolors.lst
 -------------
|copyright 1988|
| comal users  |
|group usa ltd |
 -------------
|5501 groveland|
| madison, wi  |
|    53711     |
 -------------
|  please do   |
|     not      |
|  give out    |
|copies of this|
|    disk      |
 -------------
```

Today Disk 23 Back

```
 boot for 2.0
bannerprinter2.0
cryptograms2.0
demo/calc2.0
diff'lmtd'agg
freecatalogdb2.0
graphsideways2.0
hark.xmas.song
param'graph2.0
stringsets2.0
 -------------
|  data files  |
 -------------
1985 kwh.grf
1986 kwh.grf
1987 kwh.grf
1988 kwh.grf
average kwh.grf
average temp.grf
dat.cryptograms1
db.freecats
dif'lim.hrg
doctorwho.ran
message1.txt
nana dollars.grf
nana sales.grf
whoyears.dat
 -------------
| procs/funcs  |
 -------------
func.get'input
func.value
proc.calculator
proc.prompt
 -------------
|program files |
|listed to disk|
|- to retrieve |
|  them use:   |
 -------------
|new           |
|enter         |
 -------------
|for 2.0 cart &|
|power driver. |
 -------------
who-database.lst
who-printout.lst
messageboard.lst
 -------------
|2.0 cart only |
 -------------
who-edit-2.0.lst
 -------------
|copyright 1988|
| comal users  |
|group usa ltd |
 -------------
|5501 groveland|
| madison, wi  |
|    53716     |
 -------------
|  please do   |
|     not      |
|  give out    |
|copies of this|
|    disk      |
 -------------
```

Today Disk 24

```
bootslow
fastboot
ml.sizzle
power driver
hi
 -------------
| power driver |
|   programs   |
 -------------
d-read'write.pwr
filemaster.pwr
listerine.pwr
 -------------
|2.0 cartridge |
|   programs   |
 -------------
fandsgrapher
xyz words!
xyz.puzzle
 -------------
|comal-fortran |
|  translator  |
 -------------
fortran.lst
 -------------
| 2.0 pictures |
|   package    |
 -------------
pics demo
pkg.pics
pic a dragon
hrg.trek
 -------------
|listed to disk|
|   programs   |
 -------------
| use enter to |
|retrieve them |
|2.0 check the |
| // comments  |
|  for notes   |
 -------------
```

DISK DIRECTORIES

```
chaos.lst
fracpattern1.lst
fracpattern2.lst
fracpattern3.lst
fracpattern4.lst
fracpattern5.lst
fracpattern6.lst
fracpattern7.lst
mastermind.lst
 -------------
| power driver |
|procedures and|
|  functions   |
 -------------
changedrv.lst
setprinter.lst
turtleparm.lst
 -------------
| common comal |
| test system  |
 -------------
commontest.cart
commontest.pwr
file-io.cart
file-io.pwr
strings.lst
using.lst
 -------------
|copyright 1989|
 -------------
| comal users  |
|group usa ltd |
|5501 groveland|
|  madison wi  |
|    53716     |
 -------------
|please do not |
|  give out    |
|copies of this|
|    disk      |
 -------------
```

IBM

IBM PC COMAL 2.2 Disk 1

CO	BAT
COH	BAT
COMAL	EXE
INIT	CML
INITH	CML
COMALC	EXE
COMAL	RUN
PROTECT	EXE
GRAPHV	PKG
GRAPHH	PKG
COMALC	PKG
SOUND	PKG
ENGLISH	CML
ENG	CML
ENGG	CML
ENGLISH	MSG
ENG	MSG
ENGG	MSG
DEUTSCH	MSG
DEU	MSG
DEUG	MSG
DANSK	MSG
DAN	MSG
DANG	MSG
ESPAÑOL	MSG
ESP	MSG
ESPG	MSG
SVENSKA	MSG
SVE	MSG
SVEG	MSG
FINDC	CML
FINDC	ARF
ARG	LST

33 Files

IBM PC COMAL 2.2 Disk 2

CO87	BAT
COH87	BAT
COMAL87	EXE
GRAPHV87	PKG
GRAPHH87	PKG
COMAL87	RUN
TEST	DOC
TEST	ASM
TEST	PKG
TEMPLATE	ASM
COMAL	SYM
READ	ME
COMAL	RME
GRAPHV	RME
COMALC	RME
HERCULES	DOC
SOUND	DOC

17 Files

IBM PC COMAL 2.2 Disk 3

<DIR> SUPP

SOUND	CML
SCALES	CML
POLYGON	CML
BEAR	CML
TREE	CML
ARC	CML
BOUNCE	CML
COLORS	CML
PAINT	CML
CALENDAR	CML
XREF	CML
XREF	LST
FIND	CML
INPUT	CML
SUBTREE	CML
HANOI	CML
BUSINESS	CML
BOX	CML
QUICK	CML
EVAL	CML
GAUSS	CML
LIFE	CML
FILEDATE	CML
RGB	CML
CMY	CML
HLS	CML

<DIR> TUTUK

E-PROG01	CML
E-PROG02	CML
E-PROG03	CML
E-PROG04	CML
E-PROG05	CML
E-PROG06	CML
E-PROG07	CML
E-PROG08	CML
E-PROG09	CML
E-PROG10	CML
E-PROG11	CML
E-PROG12	CML
E-PROG13	CML
E-PROG14	CML
E-PROG15	CML
E-PROG16	CML
E-PROG17	CML
E-PROG18	CML
E-PROG19	CML
E-PROG20	CML
E-PROG21	CML
E-PROG22	CML
E-PROG23	CML
CDOS-EX1	CML
CDOS-EX2	CML
CSTR-EX1	CML
CSTR-EX2	CML
CSTR-EX3	CML
CSTR-EX4	CML
CSTR-EX5	CML
CSTR-EX6	CML
ATNC-ENG	CML
SORT-ENG	CML
LIX-ENG	CML
REGR-ENG	CML
3DGR-ENG	CML
PRES-ENG	CML
DBAS-ENG	CML
TANK-ENG	CML
FILE-ENG	CML
DEMOEX	CML
EDIT-ENG	CML
DEMO	ASM
DEMO	PKG
STORAGE	RAN
DATABASE	DEX
DATABASE	REG
HCAND	TXT
USCON	TXT

<DIR>HERCULES

ARC	CML
BEAR	CML
BOUNCE	CML
BUSINESS	CML
PAINT	CML
POLYGON	CML
TREE	CML
E-PROG03	CML
E-PROG04	CML
E-PROG12	CML
E-PROG18	CML
REGR-ENG	CML
3DGR-ENG	CML

<DIR>UNIDUMP

UNIDUMP	PKG
UNIDUMP	DOC

90 Files

IBM PC COMAL Special Series 1

TESTWIND	LST
WINDOWS	LST
CALENDR	LST
MAGICSQR	LST
NIM	LST
NUMTOWOR	LST
HANOI	LST
DATABASE	LST
STARTREK	RND
DOCWHO	RND
FILEIO	LST
MULTIDEN	LST
ABS	LST
AND	LST

DISK DIRECTORIES

AT	LST
ATN	LST
BITAND	LST
BITOR	LST
BITXOR	LST
CASE	LST
CHR	LST
CLOSED	LST
COS	LST
CURCOL	LST
CURROW	LST
CURSOR	LST
DATA	LST
DIM	LST
DIV	LST
DO	LST
ELIF	LST
ELSE	LST
ENDCASE	LST
ENDFOR	LST
ENDFUNC	LST
ENDIF	LST
ENDLOOP	LST
ENDPROC	LST
ENDTRAP	LST
ENDWHILE	LST
EOD	LST
ERR	LST
ERRTEXT	LST
ESC	LST
EXEC	LST
EXIT	LST
EXP	LST
EXTERNAL	LST
FALSE	LST
FOR	LST
FREE	LST
FUNC	LST
GOTO	LST
HANDLER	LST
IF	LST
IMPORT	LST
IN	LST
INT	LST
LEN	LST
LOG	LST
LOOP	LST
MOD	LST
NOT	LST
NULL	LST
OF	LST
OR	LST
ORD	LST
OTHERWIS	LST
PI	LST
PROC	LST
RANDOMIZ	LST
READ	LST
REF	LST
REPEAT	LST
REPORT	LST
RESTORE	LST
RETURN	LST
RND	LST
SGN	LST
SIN	LST
SPC	LST
SQR	LST
STEP	LST
STR	LST
TAB	LST
TAN	LST
TESTTEST	LST
THEN	LST
TO	LST
TRAP	LST
TRUE	LST
UNIT	LST
UNTIL	LST
VAL	LST
WHEN	LST
WHILE	LST
ZONE	LST
COMMON4	LST

98 Files

IBM PC COMAL 3.0 System 1

COMAL	EXE
COMAL87	EXE
COMAL	PRO
COMALUS	PRO
COMALGR	PRO
COMALDK	PRO
SYSTEM	EXE
SOUND	EXE
INIT	CML
COMALUS	MSG
COMALGR	MSG
COMALDK	MSG
COMAL	RME
SOUND	RME
README	1

15 Files

IBM PC COMAL 3.0 System 2

GRAPHICS	EXE
GRAPHI87	EXE
TURTLE	EXE
TURTLE87	EXE
GRAPHH	EXE
GRAPHH87	EXE
TURTH	EXE
TURTH87	EXE
GRAPHIUS	MSG
GRAPHIGR	MSG
GRAPHIDK	MSG
TURTLEUS	MSG
TURTLEGR	MSG
TURTLEDK	MSG
GRAPHHUS	MSG
GRAPHHGR	MSG
GRAPHHDK	MSG
TURTHUS	MSG
TURTHGR	MSG
TURTHDK	MSG
GRAPHICS	RME
GRAPHH	RME
README	2

23 Files

IBM PC COMAL 3.0 COMPILER

COMALC	EXE
COMAL	RUN
COMAL87	RUN
COMC	EXE
COMC	LST
PROTECT	EXE
RUNUS	MSG
RUNGR	MSG
RUNDK	MSG
CFIND	LST
CFIND	CML
CFIND	ARF
ARG	LST
COMALC	RME
README	5

15 Files

IBM PC COMAL 3.0 SCOM

SCOM	EXE
SCOMUS	MSG
SCOMGR	MSG
SCOMDK	MSG
COM_DEMO	LST
COM_DEMO	HLP
EXAMPLE1	LST
SCOM	RME
README	6

9 Files

IBM PC COMAL 3.0 Supplemental Programs

ACKER	LST
ARC	LST
BEAR	LST
BEAR_VGA	LST
BOUNCE	LST
BOX	LST
BUSINESS	LST
CALENDAR	LST
CALEXT	LST
CALMOD1	LST
CALMOD1	MOD
CALMOD2	LST
CALMOD2	MOD
CMY	LST
COLORS	LST
COMPLEX	LST
COMPLEX2	LST
DIFF	LST
DIFF$	FNC
DIFF$	LST
DIFFEXT	LST
EVAL	LST
FIND	LST
FRAC	LST
FRAC	STR
FRACEXT	LST
FRACS	LST
FRACTION	LST
GAUSS	LST
HANOI	LST
HLS	LST
INPUT	LST
LIFE	LST
LIST	LST
MANDEL	LST
MANDEL	MD6
PAINT	LST
PERMUTE	LST
POLYGON	LST
POLYGON2	LST
PRIM	LST
PRIMES	LST
QUEUE	LST
QUICK	LST
RADIX	LST
RGB	LST
SCALES	LST
SIEVE	LST

DISK DIRECTORIES

```
SOUND      LST
STACK      LST
SUBTREE    LST
TREE       LST
TREEFIG    LST
TREE_CGA   LST
XREF       LST
README     3
<DIR>HERCULES
3DGR-ENG   LST
ARC        LST
BEAR       LST
BOUNCE     LST
BUSINESS   LST
PAINT      LST
POLYGON    LST
REGR-ENG   LST
TREE_HG    LST
  65 Files
```

IBM PC COMAL 3.0 Supplemental Modules

```
GENMSG     EXE
GENMSG     RME
MAKEPRO    LST
MAKEPRO    HLP
README     4
<DIR> EVENT
UNITIMER   EXE
TIMER1     LST
UNITIMER   RME
<DIR>UNIMOUSE
UNIMOUSE   EXE
UNIMOUUS   MSG
UNIMOUGR   MSG
UNIMOUDK   MSG
MOUSE1     LST
MOUSE2     LST
MOUSE3     LST
MOUSE4     LST
MOUSE5     LST
MOUSE6     LST
MOUSE7     LST
UNIMOUSE   RME
<DIR>UNIDUMP
UNIDUMP    EXE
UNIDUMP    RME
  22 Files
```

CP/M

CP/M COMAL 2.10

```
COMAL      COM
INSTALL    COM
INSTALL    DAT
BEST1ST    TXT
COMALANG   TXT
COMALYOU   TXT
FRUSTRAT   TXT
HI         SAV
INSTALLD   SAV
KEYSC128   SAV
STARTED    DOC
CMDLIST    DOC
NAMES      DTA
  13 Files
```

CP/M COMAL 2.10 RUNTIME

```
RUNTIME    COM
INSTALL    COM
INSTALL    DAT
  3 Files
```

CP/M COMAL 2.10 Demo Disk

```
BEST1ST    TXT
CALENDAR   SAV
COMALANG   TXT
COMALYOU   TXT
DEMCOMAL   COM
FRUSTRAT   TXT
HANOI      SAV
HI         SAV
INSTALL    COM
INSTALL    DAT
INSTALLD   SAV
KEYSC128   SAV
MAGICSQR   SAV
NIM        SAV
NUM2WORD   SAV
PHONE      DTA
PHONEBK    SAV
PRIMES     SAV
PRINTERR   SAV
PRINTUSE   SAV
SORTING    SAV
TRIANGLE   SAV
STARTED    DOC
CMDLIST    DOC
NAMES      DTA
  25 Files
```

DISK DIRECTORIES

AMIGA

AmigaCOMAL

AmigaCOMAL
AmigaCOMAL.info
AmigaCOMAL.pref
C
devs
  keymaps
Externals
fonts
InitAmigaCOMAL
Install
keywords
  abs.lst
  accountnam.dat
  acs.lst
  allocate.lst
  and.lst
  andthen.lst
  append.lst
  argarray.lst
  argnum.lst
  asn.lst
  at.lst
  atn.lst
  auto.lst
  bitand.lst
  bitor.lst
  bitxor.lst
  bye.lst
  case.lst
  cat.lst
  cd.lst
  chain.lst
  change.lst
  chdir.lst
  chr.lst
  close.lst
  closed.lst
  con.lst
  copy.lst
  cos.lst
  create.lst
  curcol.lst
  currow.lst
  cursor.lst
  data.lst
  date.lst
  datetime.log
  deallocate.lst
  del.lst
  delete.lst
  dim.lst
  dir.lst
  discard.lst
  display.lst
  div.lst
  editdata.sav
  elif.lst
  else.lst
  end.lst
  endcase.lst
  endfor.lst
  endfunc.lst
  endif.lst
  endloop.lst
  endproc.lst
  endrecord.lst
  endtrap.lst
  endwhile.lst
  enter.lst
  eod.lst
  eof.lst
  err.lst
  errfile.lst
  errtext.lst
  esc.lst
  exec.lst
  exit.lst
  exp.lst
  export.lst
  external.lst
  false.lst
  field.lst
  file.lst
  find.lst
  float.lst
  for.lst
  free.lst
  freefile.lst
  func.lst
  get.lst
  global.lst
  goto.lst
  handler.lst
  if.lst
  import.lst
  in.lst
  indata.sav
  inkey.lst
  inout.lst
  input.lst
  inputfile.lst
  int.lst
  key.lst
  label.lst
  len.lst
  let.lst
  list.lst
  listpack.lst
  load.lst
  log.lst
  loop.lst
  main.lst
  makedir.lst
  maxindex.lst
  memwindow.lst
  merge.lst
  minindex.lst
  mkdir.lst
  mod.lst
  new.lst
  next.lst
  not.lst
  null.lst
  open.lst
  or.lst
  ord.lst
  otherwise.lst
  output.lst
  page.lst
  pass.lst
  pi.lst
  pointer.lst
  print.lst
  printfile.lst
  printout.sav
  proc.lst
  random.lst
  randomize.lst
  read.lst
  readfile.lst
  readwrite.lst
  record.lst
  ref.lst
  rename.lst
  renumber.lst
  repeat.lst
  report.lst
  restore.lst
  retry.lst
  return.lst
  rnd.lst
  round.lst
  run.lst
  runwindow.lst
  save.lst
  scan.lst
  scores.dat
  select.lst
  sgn.lst
  sin.lst
  size.lst
  spc.lst
  sqr.lst
  step.lst
  stop.lst
  str.lst
  tab.lst
  table1.dat
  table2.dat
  tan.lst
  temp.lst
  test.ran
  then.lst
  time.lst
  timer.lst
  to.lst
  trace.lst
  trap.lst
  trapesc.lst
  true.lst
  unit.lst
  until.lst
  use.lst
  using.lst
  val.lst
  varsize.lst
  visitor.dat
  wait.lst
  welcome.ext
  when.lst
  while.lst
  write.lst
  writefile.lst
  zone.lst
L
  Disk-Validator
  Port-Handler
  Ram-Handler
libs
Mine
  type.lst
  type.pck
  type.sav
  type.sav.info
Packages
  CFront.pck
  CLIpass.pck
  ComalExcept.pck
  Dansk.pck
  DataBase.pck
  Devices.pck
  DISKFONT_library
  DOS_library.pck
  EditText.pck
  EXEC_library.pc
  Functions.pck
  GFX.pck
  Graphics.pck
  GRAPHICS_library
  ICON_library.pck
  Integral_ASM.pck
  Integral_C.pck
  INTUITION_library
  Layers.pck
  LAYERS_library.
  MandelStep_ASM.pck
  MandelStep_C.pck
  MandelStep_COMAL.pck
  Math.pck
  Messages.pck
  nopass.pck
  packages.pck
  PCgraphics.pck
  Potgo_library.pck
  RastPort.pck
  SayError.pck
  Screens.pck
  Speech.pck
  Speech.sav
  system.pck
  System_CODE.pck
TRANSLATOR_library.pck
  Turtle.pck
  TurtleSmall.pck
  type.pck
  View.pck
  Windows.pck
Programs
  ConsoleIO.sav
  DataBase.sav
  demo.sav
  Hanoi.sav
  Install.sav
  Integral.sav
  lines.sav
  magicsquare.sav
  Mandelbrot.sav
  Maze.sav
  SortKat.sav
  SpeechDemo.sav
  SpeechDemo2.sav
  SpeedBar.sav
  spiro.sav
  Terminal.sav
  testpar.sav
  tree.sav
QView
readme
S
  startup-sequence
TestSystem
  ahls.lst
  calc.lst
  common.lst
  fileio.lst
  sieve.lst
  sieveprint.lst
  speedbar.sav
  sqrsin.lst
  strings.lst
  trig.lst
  using.lst

COMAL Developers Disk

Compiler
  BLink
  ComalComp
  Compile
  Compile.info
  Runtime.obj
Docs
  Asm68k.doc
  BLink.doc
  Mini.Doc
PackDevAsm
  C
    Asm68k
    Blink
  Include
    diskfont.i
    dos.i
    exec.i
    graphics.i
    icon.i
    intuition.i
    layers.i
    Package.i
    Translator.i
  Packages
  Sources
    Bin.asm
    ConDevice.asm
    EvenOdd.asm
    genpack
    genpack1
    Help.asm
    Math.asm
    MaxLen.asm
    Translator.asm
PackDevC
  C
    Blink
  Include
    Comal
      comal.h
  Lib
    Comal.lib
  Packages
  Sources
    Dansk.c
    genpack
    Integral.c
    Math.c
    p.o
    PCgraphics.c
    SayError.c
PackSources
QView
readme

DISK DIRECTORIES

WorkBench Boot

Note: you need WShell, ARexx & FACC II to get all the files.

- C
  - AddMem
  - Alias
  - Arc
  - Ask
  - Assign
  - Avail
  - BaseName
  - Binddrivers
  - booz
  - Break
  - CD
  - ChangeTaskPri
  - Cmp
  - ConMan
  - Copy
  - Date
  - Delete
  - Dir
  - DiskChange
  - Dropbuf
  - E
  - EndCLI
  - EndSkip
  - Eval
  - ExecIO
  - Execute
  - Fault
  - FF
  - FileNote
  - flush
  - GetEnv
  - hi
  - History
  - IconX
  - Info
  - Install
  - Join
  - List
  - LoadLib
  - LoadWB
  - Lock
  - MakeDir
  - morerows
  - Mount
  - Move
  - PatchWB
  - Path
  - Protect
  - Push
  - QMouse
  - Queue
  - Read
  - Relabel
  - Rename
  - Resi
  - rexxmast
  - Run
  - RunBack
  - RunWSH
  - rx
  - rxc
  - rxlib
  - rxset
  - Say
  - Search
  - Set
  - SetClock
  - SetCMan
  - SetDate
  - SetEnv
  - SetExecute
  - SetPatch
  - setup.rexx
  - SetWSH
  - Show
  - Sort
  - Sound
  - Status
  - TackOn
  - tcc
  - tco
  - te
  - Tee
  - ts
  - Type
  - UnZip
  - Version
  - VirusX
  - Wait
  - WaitForPort
  - Which
  - Why
  - zoo
- devs
  - clipboard.devic
  - clipboards
  - keymaps
    - usa1
  - mountlist
  - mountlist-conman
  - MountList-Orig
  - narrator.device
  - parallel.device
  - printer.device
  - printers
    - Epson
    - generic
    - HP_LaserJet
  - ramdrive.device
  - serial.device
  - system-configuration
- fonts
  - diamond
    - 12
    - 20
  - diamond.font
  - topaz
    - 11
  - topaz.font
- L
  - conhandler
  - Disk-Validator
  - Port-Handler
  - Ram-Handler
  - Speak-Handler
- libs
  - arp.library
  - asdg-low-mem.library
  - conhandler.library
  - diskfont.library
  - icon.library
  - info.library
  - mathieeedoubbas.lib
  - mathieeedoubtrans.lib
  - mathtrans.library
  - rexxarplib.library
  - rexxsupport.library
  - rexxsyslib.library
  - screenshare.library
  - translator.library
  - version.library
  - wshell.library
- More
- NewWSH
- PPrefs
- readme
- S
  - .dosrc
  - delete-ram
  - delete-resi
  - env
    - echo
    - path
    - shellwindow
    - titlebar
  - finish-max
  - finish-min
  - histinit.data
  - LoadAlias
  - LoadResi
  - nag.config
  - nagsound
  - QMouse.cfg
  - startup-sequence
  - startup-sequence2
  - startup-wshell
- System
  - DiskCopy
  - FaccII
  - FastMemFirst
  - Format
  - InitPrinter
  - SetMap
  - spool
  - UmUtil
- testrexx
- UMast69
- umast69.info

BOOT2

- BootDocs
  - morerows.doc
  - pprefs.doc
  - QMouse.doc
  - UtiliDocs
  - WB1.3.2-LICENSE
  - WB1.3.2-ReadMe
- C
  - ARun
  - Dmouse
  - Echo
  - Else
  - EndIf
  - Failat
  - If
  - Lab
  - Play
  - Prompt
  - Quit
  - Resident
  - Skip
  - Stack
- ClickDosII
  - ClickDOS-Startup
  - ClickDOS.pic
  - ClickDOSV2.06
  - ClickDOS_II
  - ClickDOS_II.doc
  - ClickDOS_II.doc
  - ClickDOS_II.info
  - INSTALL
  - less
  - Read_Me
  - Spool
- Facction
  - Facction
- L
  - Aux-Handler
  - Dmouse-Handler
  - FastFileSystem
  - Newcon-Handler
  - Pipe-Handler
  - Shell-Seg
- More
- morerows
- Nag
  - Commercial
  - Nag
  - Nag.17notes
  - Nag.1989
  - Nag.1990
  - Nag.config
  - Nag.config2
  - Nag.doc
  - Nag.install
  - Nag.PROMO
  - Nag.year
  - ReadMe!
- PCUtil2
  - AtariDS.Format
  - AtariSS.Format
  - FormatEd
  - PcC720
  - PCCopy
  - PcF720
  - PCFormat
  - PcPatch.doc
- Prefs
  - Pointer.info
  - Preferences
  - Printer.info
  - Serial.info
- S
  - DPAT
  - PCD
  - SPAT
- ScreenX
  - ScreenX
  - ScreenX.docs
- System
  - booz
  - CMD
  - GraphicDump
  - InstallPrinter
  - MergeMem
  - NoFastMem
  - PrintFiles
  - Unarc
  - UnZip

READERS

- C
  - MuchMore
- CType1.0
  - CLI-Only
    - CLS
    - PlusCR
    - StripCR
    - StripLF
  - CType
  - CType.info
  - HT
  - ReadME
  - Source
    - CLS.s
    - CType
    - CType.s
    - Includes
      - DosEquates.ASM
      - Header.ASM
      - IntEquates.ASM
      - Macros.ASM
      - Startup.ASM
      - SysEquates.ASM
    - PlusCR.s
    - ReadMe2
    - StripCR.s
    - StripLF.s
- Distribution
- FullView
  - FullView
  - FullView.doc
  - FVCompress
- Less
  - less
  - Less.doc
  - less.help
  - makefile
  - README
  - ReadMe.doc
  - Src
    - ch.c
    - command.c
    - funcs.h
    - help.c
    - input.c
    - io.c
    - less.h
    - line.c
    - main.c
    - option.c
    - os.c
    - output.c
    - position.c
    - position.h
    - prim.c
    - print.c
    - prompt.c
    - screen.c
    - signal.c
    - ttyin.c
    - version.c
- More
  - More
- Most
  - Most
- MouseReader
  - MouseReader

DISK DIRECTORIES

MouseReader.doc
MuchMore
MuchMore
ReadMe
Print
Print
QView
QView
QView.doc
Rd
rd
Read
read
ReadAll
ReadAll
readme
Strings
strings
TextDisplay
ReadMe!
TextDisplay
TextDisplayD
TextFormat
TextFormat
Ty
README
ty
ty.gadget.pic
Type
Type
View
POSTER
View
View.doc
WordCount
Wordcount
Wordcount.c

Text Editors

ANSIEd
Demo
Demo.doc
EASTER.ANSI
FILE.ANSI
FLAG.ANSI
GRAPE.ANSI
MAIN.ANSI
MB.ANSI
Samples.doc
Avi
Avi
Avi.doc
POSTER
C
less
MuchMore
CygnusEd.demo
ceddefaults
ceddefaults.asm
ceddefaults.c
ceddemo
cedhelp.hlp
cedmacros
ReadMe
Distribution
Hed
hed
README
Jed
echo
execute.me
Jed
Jed.Dox
Jed.Help
more
readme
startup.seq
system.con
Qed
qed
Qed_Intro.doc
Qed_New.doc
Qed_Plans.doc
Qed_User.doc
READ.ME
Readme.first
Textra
Textra
Textra.doc

ARP & DOCs

arp13
.info
Arp.readme
ArpInsta.ll
AshMan
arpdocs
addbuffers
arun
ask
assign
break
cd
changetaskpriority
copy
date
delete
dir
diskchange
echo
failat
filenote
fixarp5.sav
if
info
install
join
lab
list
loadlib
makedir
mount
path
prompt
protect
quit
Readme.arp
relabel
rename
resident
search
set
setdate
skip
sort
stack
status
type
usermanual
Version.arp
wait
ArpSupport
ARPLICENSE
CREDITS
DISCLAIMER
INCLUDE
ArpBase.h
arpbase.i
arp_lib.fd
LATTICE
arp_proto.h
latticeglue.a
MANX
a.lib
arp.lib
clihelp.c
cliparse.c
clitemp.c
crt0.asm
dospkt.asm
exit.c
fmalloc.c
fprintf.asm
gads.c
makefile
printf.asm
scdir.c
sprintf.asm
toupper.asm
tracker.asm
vars.c
wbparse.c
_exit.c
_main.c
NEW_MANUAL
ArpAllocFreq
ArpOpenLibrary
ASyncRun_ADDENDUM
FileRequest_ADDEND
FindFirst_ADDENDUM
GetEnv_ADDENDUM
GetKeywordIndex
PatternMatch_ADDEN
SPrintf
StamptoStr_ADDEND
SyncRun_ADDENDUM
OLD_MANUAL
AddDADevs
AddDANode
AddResidentPrg
ArpAlloc
ArpAllocMem
ArpDupLock
ArpExit
ArpLock
ArpOpen
Assign
ASyncRun
Atol
BaseName
BtoCStr
CheckAbort
CheckBreak
CheckSumPrg
CloseWindowSafe
CompareLock
CreatePort
CreateTaskResLi
CtoBStr
DeletePort
DosAllocMem
DosFreeMem
EscapeString
FileRequest
FindCLI
FindFirst
FindNext
FindTaskResList
FPrintf
FreeAccess
FreeAnchorChain
FreeDAList
FreeTaskResList
FreeTrackedItem
GADS
GetAccess
GetDevInfo
GetEnv
GetTracker
InitStdPacket
LDiv
LMod
LMult
LoadPrg
ObtainResidentP
PathName
PatternMatch
PreParse
Printf
Puts
QSort
ReadLine
ReleaseResident
RemResidentPrg
RListAlloc
SendPacket
SetEnv
StamptoStr
Strcmp
Strncmp
StrtoStamp
SyncRun
TackOn
Toupper
TRAK_ID
UnLoadPrg
Programmers_manual
PRO_README
ConManDocs
ConMan.doc
DropBuf.doc
History.doc
mountlist-conman
Push.doc
Queue.doc
README
NagDocs
Commercial
Nag.17notes
Nag.doc
Nag.install
Nag.PROMO
ReadMe!
request-dec88
arp.bmap
arp.library
req.msb
request-jan89
areq.ml
areq1
areq2
areq3
arpreq
jlib
ml_loader
post
request-nov88
arp.bmap
exec.bmap
FileReq
read.me

Notes

AmigaCOMAL disk may soon be expanded into a two disk set.

The BOOT disk set now consists of three disks. You must send us your WorkBench disk when you order to prove you own WorkBench. You also must get WShell, since most of the system is built around it. It is the best shell out! If you do not get FACC II and ARexx, some listed files will not be on your disk that are shown in the directory.

I think I have all the DOC files back with the programs, but if I missed any, please let me know. It may turn into a four disk set. Some included programs are shareware.

UtiliMaster is shareware. I am testing the next release and it is fantastic. Please register your copy so he will release the next version!

Text Readers & Editors let you try many types to find one you like best. Many are shareware.

We desparately need some COMAL Demo programs for a Demo disk! Send your submissions in as soon as you can.

We also want to put together a supplemental packages disk. If you write your own packages, consider sharing them with other COMALites. You can submit them on disk, or via People Link or CompuServe.

ORDER FORM Subscriber #_____

Name:_____

Street:_____

City/St/Zip:_____

Visa/MC#:_____

Exp Date:_____ Signature:_____
Nov '89-Prices subject to change without notice

TO ORDER:

- Fill in subscriber# / address (above)
  (new subscribers write new for subscriber #)
- Check [x] each item you want to order
- Add up items/shipping/handling (fill in below)
  (shipping fee is often less than the max listed)
- Send check/money order or charge it (above)
- Charge orders may call 608-222-4432
- or Mail to: **COMAL Users Group, U.S.A., Ltd.**
  5501 Groveland Terrace, Madison, WI 53716

SUBSCRIPTIONS:

Expired subscribers must renew before they may order at subscriber prices (renewal starts with the issue where you left off). New subscribers can order at the same time as subscribing.

[____] <=How many issues? $4 per issue (max 5)
(Canada/APO add $1 per issue, 1st Class)
[____] <=How many disks? $9 per disk (max 5) (C64)

[_] $4.95 each for backissues; circle ones wanted:
1 2 4 5 6 7 8 9 10 11 12 13
14 15 16 17 18 19 20/21 22 23 24
[_] $9.95 each, C64 COMAL Today Disks; circle to order:
1/2 3/4 5 6 7 8 9 10 11 12 13
14 15 16 17 18 19 20/21 22 23 24

Notice: **All orders must be prepaid in US dollars. Minimum order $10. Minimum shipping is $3 (does not apply to subscription only orders); Canada, APO & 1st Class add $1 more per newsletter and book. Newsletter is published as time permits (no set schedule); size and format varies. Cancelled subscriptions receive no money back. Orders accepted from Canada and USA only. Prices shown are subscriber prices and reflect a $2 discount. Allow 2 weeks for checks to clear. $15 charge for checks not honored. Prepaid PO's from companies accepted only if no conditions of sale apply. Wisconsin residents add 5% sales tax and if your county charges a county tax, include it as well.**

ENTER TOTALS HERE:

Item Total ($10 minimum):$_____
Ship Total ($3 minimum):$_____
Wisconsin tax:
Grand Total enclosed:$_____

BACKISSUES - COMAL Today

Price per issue: $4.95 (no extra shipping other than min)
(circle numbers on the left; matching disks are also available)

1 - Original first issues still available (not reprints). Only a few copies left.

2 - PRINT FILE versus WRITE FILE; Recursion; Stack overflow; Functions/Parameters

3 - sold out

4 - Graphics screen dump in COMAL; spirolateral; Dodge 'em; Music; arrays /parameters
Issues 1-4 Spiral bound: (see COMAL Yesterday/book)

5 - How COMAL statements are stored; strings; Target; Inventory; Pitfall Harry

6 - Memory maps; 2.0 & 0.14 compared; Shadow letters; Draw molecule; Function keys

7 - COMAL Standards meeting; Book reviews; Function keys; External procs

8 - Sprites; Soundex; Forest; Sound; Fun print; Recursion; Font sprites; Depreciation

9 - Modems; Ascii codes; TRAP; Function keys; Metamorphose sprite; Bitmaps; Sizzle; C64 'cart internal structure & token table; Rod the Roadman; Strings; Icon Editor

10 - Sorts; Font Editor; Draw; Walker; Phone Database; Missing Letters; Designer; Compressed bitmaps; Meta; Compare disk files; Easy Curves

11 - 2.0 keywords chart; Disk directories; Pop Over; Graphics Editor System; Ram disk

12 - Cart package keywords chart; Rabbit; 3D Fractals; Cart schematics; 2 column printing; Pic Finder; Benchmarks; Free form database; Transfer programs from 0.14 to 2.0; Kelly's Beach
Index to issues 1-12, 4,848 entries, 56 pgs; (see books)

13 - Superchip keywords chart; Sprites; Wheel of Fortune; Sets; Benchmarks; BASIC into COMAL; Encryption; C128 package; Kastle

14 - Outliner; Listerine; Scope; Stacks; CASE statement; Calendar; Multi-directory; Modems

15 - Over 60 0.14 Proc/Func listed!; Dr Who database; Program construction; Wheel of Fortune

16 - Smart file reader; Text input window; Magic squares; Easy instructions; Read & Run; Learn subtraction; NIM; Tiny directory; Sorts

17 - COMAL Kernal in full; Ram expander; Sprites; Calculate PI; 0.14 graphic/sprite chart

18 - Reversi; Poetry; Hammurabi; Puzzle; Zip Zone; Fractal geometry / Mandelbrot; stacks

19 - Power Driver keywords chart; Sample book pages; Coloring book; Rotating 3D

20/21 - Files; Black box; Best of 1-19

22 - Walking sprites; Animals; Maze; Music

23 - Message board; Programming; Graphing

24 - Common COMAL; Picture Package; Chaos

DISKS ORDER FORM DISKS

Disks are $9.95 each. Unless the disk label specifically states that you may give out copies, our disks may not be copied or placed into club disk libraries. **Choose from the disks below:**

[ ] Amiga Today Disk 25
[ ] Amiga Borge Christensen digitized pics
[ ] Amiga Text Readers
[ ] Amiga Text Editors

[ ] IBM Today Disk 25
[ ] IBM Special Series Disk #1
[ ] IBM Special Series Disk #2 (Test System)

[ ] CP/M COMAL Demo Disk ($5)

[ ] Beginning COMAL disk §
[ ] Today INDEX disk § (2 disks count as 1)
[ ] Games Disk #1 (0.14 & 2.0)
[ ] Modem Disk (0.14 & 2.0)
[ ] Article text files disk

Today Disks:
[ ] Today Disk (one disk type--circle choices):
1 2 3 4 5 20&21 24 25
[ ] Today Disk (double sided -- circle choices):
6 7 8 9 10 11 12 13 14 15 16 17 18 19 22 23

0.14 Disks:
[ ] NEW: Sid Siferlein disk set (3 disks count as 1)
[ ] Data Base Disk 0.14
[ ] New: Power Driver Tutorial Disk
[ ] Auto Run Demo Disk
[ ] Paradise Disk
[ ] Best of COMAL
[ ] Bricks Tutorial (2 disks count as 1)
[ ] Utility Disk 1
[ ] Slide Show disk (circle which): 1 2
[ ] Spanish COMAL
[ ] User Group 0.14 disks (circle numbers):
1 2 3 4 5 6 7 8 9 10 12

2.0 Disks:
[ ] NEW: Robert Ross Technical Disk ($2)
[ ] NEW: Ajax School disk set (2 disks count as 1)
[ ] NEW: Norquay School disk
[ ] Data Base Disk 2.0
[ ] Superchip Programs disk
[ ] Read & Run
[ ] Math & Science
[ ] Typing disk (2 disks count as 1)
[ ] Cart Demo (circle which): 1 2 3 4
[ ] 2.0 user disks (circle choices): 11 13 14 15

§ = these disks assume you have the book

Note: Some disks may be supplied on the back side of another disk. Disk format is Commodore 1541 unless specified otherwise. We replace any defective disk at no charge if you return the disk with a note explaining what is wrong with it. Some disks are being reduplicated and appropriately relabeled.

[ ] $10.95 **Sprite Pak**
Two disk set. Huge collection of sprite images, sprite editors, viewers, and other sprite programs. For 0.14 and 2.0.

[ ] $12.95 **Font Pak**
Three disk set. Collection of many different character sets (fonts) for use with 0.14 and 2.0 including special font editors!

[ ] $14.95 **Graphics Pak**
Five disk set. Picture heaven. Includes Slide Show, Picture Compactor, Graphics Editor and lots of pictures (normal and compacted)

[ ] $29.95 **Sprite,Font & Graphics Pak**
All ten disks mentioned above!

[ ] $9.95 **C128 CP/M Graphics**
Graphics package on disk for use with CP/M COMAL on the C128. Includes turtle graphics and preliminary Font package.

[ ] $10.95 **Guitar Disks**
Three 0.14 disk set. Teaches guitar by playing songs while displaying the chords and words.

[ ] $14.95 **Cart Demo Disks**
Four disks full of programs demonstrating the many features of the C64 2.0 cartridge.

[ ] $10.95 **Shareware Disks**
Three disk set. Includes a full HazMat system (Hazardous Materials), an Expert System, Finger Print system, Traffic Calc, and a BBS program.

[ ] $14.95 **Superchip On Disk**
All the commands of Super Chip (but not the Auto Start feature) disk loaded.

[ ] $24.95 **Super Chip Source Code**
Full source code with minimal comments. Customize your own Super Chip. Add commands. Remove the ones you don't need.

[ ] $14.95 **2.0 User Group Disks**
Four disks set for the C64 COMAL cart.

[ ] $29.95 **0.14 User Group Disks**
Twelve disks (User Group disk 9 is a newsletter on disk system, double disk).

[ ] $29.95 **European Disk Set**
Twelve 2.0 disk set. Find out what COMALites in Europe are doing.

C64 - Disk Loaded

[_] **Power Driver Complete**[db] - all of the items below, Power Box, Starter Kit, and keyboard overlay. $49.95 + $6 shipping
[_] **Add $5 for Doc Box¤ binder/slipcase**

[_] **Power Driver** interpreter and 20 lesson tutorial (with turtle tutor) on disk. $9.95

[_] **Power Box**[db] - includes Power Driver interpreter and compiler, 3 utility disks, a toolbox of about 250 procedures and functions and Power Driver note pages. $29.95 + $4 ship

[_] **Starter Kit** - 12 issues of *COMAL Today*, 56 page index, 2 books and 5 disks! Over 1,000 pages! $29.95 + $4 ship

[_] **C64 Keyboard Overlay**: excellent condensed command reference. $3.95 + $1 shipping

[_] **Doc Box¤ binder/slipcase** option ... $7.95

C64 - Cartridge

[_] **COMAL 2.0 Cart Complete***
The C64 cartridge plus all the options below (except Superchip) ... Tutorials, references, packages, applications ... $179.95 + $7 ship

[_] **COMAL 2.0 Cart Deluxe***
64K cartridge; 3 reference books: *2.0 Keywords, Cart Graphics & Sound, Common COMAL Reference* plus 4 demo disks. $124.95 + $3 ship

[_] **COMAL 2.0 Cartridge***
64K cartridge with empty spot for up to 32K EPROM. Plain, no documentation. $99.95

[_] **Deluxe Option**[db]: three books: *2.0 Keywords, Cart Graphics & Sound, Common COMAL Reference*; 4 cart demo disks. $29.95+$4 ship

[_] **Packages Option**[db]: three books: *COMAL 2.0 Packages, Packages Library 1* (17 packages), *Packages Library 2* (24 packages); Superchip on Disk (9 packages). $36.95 + $4 ship

[_] **Applications/Tutorial Option**[db]: three books: *COMAL Collage, 3 Programs In Detail, Graph Paper*. $36.95 + $4 ship

[_] **Super Chip**: plug in chip for C64 cart; adds about 100 commands to the cartridge. $24.95

[_] **Doc Box¤ Binder/Slipcase Option** ... $7.95

CP/M Systems (includes C128 CP/M mode)

[_] **CP/M COMAL 2.10**
Full COMAL system disk **plus** the DEMO disk, packed in a Doc Box¤ with manual.
Works in C128 CP/M mode. $39.95 + $4 ship

[_] **Compiler Option** (RUNTIME system). $5.95
[_] **C128 Graphics Option**: Package disk $9.95
[_] **CP/M Package Guide Option**: Reference on how to write packages $14.95 + $1 ship
[_] **Common Comal Reference** option: $16.95 +$3 ship

IBM PC & compatibles

[_] **UniComal IBM PC COMAL 2.2***
Full fast system, with compiler, graphics, reference, tutorial. $165 +$5 ship
[_] **Option**: SCOM $145 (serial communication)
[_] **Option**: UniDump $45 (for laser printers)
[_] **Option**: UniMatrix $165 (matrix package)
[_] **Option**: UniMouse $45 (software mouse support)
[_] **Common Comal Reference** option: $16.95 +$3 ship

[_] **UniComal IBM PC COMAL 3.0***
Special system for professionals, static scope, modules, records, compiler. $430 +$5 ship/handling
[_] **Option**: OS/2 support $100
[_] **IBM Today Disk 25**: $9.95

Amiga (all models)

[_] **AmigaCOMAL** (prev ComWare/German Comal)
Full fast system, graphics, speech, exceptions, windows, screens, devices. $99.95 +$3 ship
[_] **Compiler/Developer Option**: $34.95 +$1 ship

[_] **Amiga Boot Disks** (3 disk set)
All installed, ready to use, many added utilities (requires WShell purchase -- also you must send a copy of your WorkBench disk to us) $9.95
[x] **WShell**: $40 (required for Boot Disks)
[_] **ARexx**: $40 (optional for Boot Disks)
[_] **FACC II**: $28 (optional floppy speedup for boot disks)

[_] **Amiga Today Disk 25**: $9.95
[_] **Borge Christensen digitized pics disk**: $9.95
[_] **Text Editors disk**: $9.95
[_] **Text Readers disk**: $9.95

COMAL Information Booklets

_____ <==How many? (20¢ each)

db = Doc Box pages
* = subject to customs/ship variations/availability
¤ = while supplies last (out of print)

[_] $2.95 **C64 COMAL 2.0 Keywords**[db]
#4 best seller for Feb 88 lists all the keywords built into the cartridge (including all 11 built-in packages) in alphabetic order complete with syntax and example. +$1 ship

[ ] $16.95 **Beginning COMAL**[¤]
#8 best seller by Borge Christensen
333 pages - General Textbook
Beginners text book, elementary school level, written by the founder of COMAL. This book is an easy reading text. You should find Borge has a good writing style, with a definite European flair. +$3 ship
[_] **Optional Matching Disk** of programs. $9.95

[_] $3.95 **COMAL From A to Z**[¤]
#1 all time best seller by Borge Christensen
64 pages - Mini 0.14 Reference book
Written by the founder of COMAL. +$1 ship

[_] $3.95 **COMAL Workbook**[¤]
#1 best seller for Feb 88 by Gordon Shigley
69 pages - 0.14 Tutorial Workbook; Companion to the Tutorial Disk, great for beginners, full sized fill in the blank style. +$1 ship
[_] **Tutorial Disk Option:** $9.95

[_] $3.95 **Index - COMAL Today 1-12**[¤]
#9 best seller by Kevin Quiggle
52 page, 4,848 entry index to COMAL Today. The back issues of COMAL Today are a treasure trove of COMAL information and programs! This index is your key. +$1 ship
[_] **Index Disk Option:** $9.95

[_] $16.95 **Common COMAL Reference**[db]
#3 best seller for Feb 88 by Len Lindsay
238 page detailed cross reference to the COMAL implementations in the USA (formerly COMAL Cross Reference) Covers: C64 COMAL 2.0, C128 COMAL 2.0, CP/M COMAL 2.10, and UniComal IBM PC COMAL. +$3 ship

[_] $19.95 **COMAL Yesterday** **Issues 1-4 of COMAL Today - Spiral bound** +$3 ship

[_] $12.95 **Library of Funcs/Procs**[db]
#1 best seller Dec 87 by Kevin Quiggle, 80 pgs, over 100 0.14 procs/funcs, with disk. +$1 ship

[_] $4.95 **Cart Graphics & Sound**[¤db]
#6 best seller by Captain COMAL
64 pages - 2.0 packages reference guide to all the commands in the 11 built in cartridge packages. +$1 ship

[_] $14.95 **COMAL 2.0 Packages**[db]
#7 all time best seller by Jesse Knight
108 pgs with disk - package reference. How to write a package in Machine Code; includes C64 comsymb & supermon. For advanced users. +$2 ship

[_] $14.95 **Package Library Vol 1**[db]
compiled by David Stidolph
76 pages with disk - package collection
17 packages ready to use, many with source code, plus the Smooth Scroll Editor! +$1 ship

[_] $14.95 **Package Library Vol 2**[db]
67 pages with disk - package collection
24 example packages ready to use, most with source code, plus Disassembler, Re-Linker, De-Linker, Package Maker, Package Lister, and more. (includes windows). +$1 ship

[_] $14.95 **COMAL Collage**[db]
by Frank and Melody Tymon
168 pages with disk, 2.0 programming guide, including graphics and sprites tutorial with many full sized example programs. +$2 ship

[_] $12.95 **3 Programs in Detail**[db]
82 pages with disk by Doug Bittinger
Three 2.0 application programs explained: Blackbook (name/address system), Home Accountant, and BBS. +$1 ship

[_] $12.95 **Graph Paper**[db]
52 pages with disk by Garrett Hughes
Function graphing system for COMAL 2.0. The program can't be LISTed. Includes a version for the Commodore Mouse. +$1 ship

[_] $12.95 **COMAL Quick /Utility 2 & 3**[db]
#2 best seller Dec 87 by Jesse Knight
20 pgs with 2 disks, fast loading COMAL 0.14, printer programs, utility programs. +$1 ship

[_] $14.95 **CP/M COMAL Package Guide**[db]
The guide to making your own packages for CP/M COMAL by Richard Bain - 76 pages - advanced package reference. +$1 ship

[_] $24.95 **Intro to COMAL** **Advance Orders**
Textbook for all COMALs by J William Leary and Len Lindsay. Aprox. 300 pages. +$3 ship
[_] **Programs disk option:** $5.95 **Check format needed:**
_____Amiga _____IBM _____C64 **(double disk)**

[=] **$16.95 Foundations with COMAL**[¤] sold out

db = Doc Box pages
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¤ = while supplies last (out of print)

AmigaCOMAL CONTROL Codes / CHR$(x) Results

Ctrl	chr$	Result
A	1	Erase to end of line
B	2	Erase to end of screen
C	3	Repeat **find** or **change** // Cursor ON
D	4	?? // Cursor OFF
E	5	
F	6	
G	7	Flash Screen
H	8	Destructive backspace
I	9	Right tab (every 8th position)
J	10	Linefeed
K	11	Left tab (every 8th position)
L	12	Clearscreen & home cursor
M	13	Carriage return
N	14	Insert line & scroll rest of lines down
O	15	Delete line & scroll rest of lines up
P	16	Reverse field toggle
	16	Background toggle (before and after color code)
Q	17	Extra half bright toggle
R	18	Underline toggle
S	19	Italic toggle
T	20	Bold toggle
U	21	Cursor to start of line
V	22	Cursor to end of line
W	23	Cursor to top of window
X	24	Cursor to bottom of window
Y	25	Delete character
Z	26	Insert character

Pen Color

Choose one of 32 colors by printing a chr$(x) where x is a value between 128-159 (hex $80-$9f).

Example:

```
PRINT chr$($80+3)  // sets color to 3
```

Print a chr$(17) before and after the color code to shift to the next 32 colors in Extra Half Bright mode (some early Amiga models may not have this mode).

Example:

```
PRINT chr$(17),chr$(130),chr$(17) //color to 35
```

Background Color

Print a chr$(16) before and after the color code to set the background to the specified color.

Example:

```
PRINT chr$(16),chr$(130),chr$(16)//background 3
```

Bit Planes

You must have installed AmigaCOMAL with enough bit planes for the screen to see all the colors. It takes 6 bit planes to display all 64 colors in Extra Half Bright mode.

How to Enter Programs

Line numbers are required for your benefit in editing a program (but are irrelevant to a **running** program). We usually omit line numbers when listing a program. It's up to YOU to provide line numbers. Of course, **COMAL can do it for you.** Follow these steps to enter a COMAL program:

1) Enter command: NEW

2) Enter command: AUTO

3) Type in the program.

4) When done, stop the AUTO mode:

Power Driver:	Hit «*return*» on blank line
PET COMAL 0.14:	Hit «*return*» on blank line
C64 2.0 Cart:	Hit «*stop*» key
C128 2.0 Cart:	Hit «*stop*» key
CP/M COMAL 2.10:	Hit «*esc*» key
AmigaCOMAL:	Hit «*esc*» key
IBM PC COMAL:	«*control*» + «C»

You may use both UPPER and lower case letters. COMAL automatically makes keywords UPPER case and variable names lower case.

You don't have to type leading spaces in a line. They are listed only to emphasize structures, and COMAL will insert them for you. You **DO** have to type a space between keywords in the program.

Long program lines: If a complete program line will not fit on one line in our listing, we continue it on the next line and add //wrapline at the end. You must type it as one continuous line.

Variable names, procedure names, and function names can be a combination of:

```
abcdefghijklmnopqrstuvwxyz0123456789'_][\
```

On the C64/128, the «*left arrow*» key (upper left corner of keyboard) is valid. COMAL 2.0 converts it into an underline. A «*British pound*» £ symbol is used in place of the \ backslash. ■