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1990 Second Quarter Review

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Spring and summer tend to be the quiet seasons in the computer chess world, and this year is no exception. Few new models have come out since our last quarterly, and there have been no radical breakthroughs in the programs. There have been a number of dramatic results by the \$10,000 Mephisto Portorose 68030, including an I.M. norm and a 40/2 victory over Grandmaster David Bronstein, who tied a world championship match with Botvinnik nearly four decades ago. Results for more affordable machines have mostly been in line with expectations. Deep Thought has been in hibernation as the IBM team has been working on an all new version intended to take out the champ in a couple years or so. Work continues by several camps on RISC machines, but so far there are no achievements worth bragging about in this area--give it a year or so.

In the commercial arena, Fidelity continues to have a monopoly on distribution in the U.S. except for Saitek. While Saitek has not been very competitive in the past three years, they C.R.A. tested two models at the U.S. Open, one with a new single chip processor--see late story. Novag prices have not risen quite as sharply as I feared, while Mephisto prices are climbing out of sight for most models. Only Fidelity prices have held at reasonable levels so far.

The steady decline in prices for fast personal computers is making the software option more attractive than ever for strength oriented buyers. While it is still generally less expensive to buy a dedicated machine than a comparable PC + chess software, the gap is no longer so wide. Perhaps the PC option will put pressure on the manufacturers to offer more power per dollar.

On a more personal note, after years of absence from tournament chess I have begun to play again in some Florida events, and in my second event I shared first with another master and with my RexChess program, operated by co-author Don Dailey! Dave Kittinger, a strong Expert, has had similar experiences in Alabama tournaments with his Novag Super Expert programs. It is not often that one has the chance to win a single event twice. I also won the Florida Action Chess Championship over strong opposition although my only practice for years has been against computers. It suggests that computers are indeed good sparring partners, especially for the faster time limits where tactics are so important.

New readers please note that I write all articles not otherwise identified, and that while I.C.D. Corp. edits, prints, subsidizes and distributes these reports, I don't work for I.C.D., and I.C.D. does not try (and has never

tried) to influence or modify the content of what I write. Also, please note that while I have just been reappointed USCF ratings committee chairman [*Congratulations, Larry - the other eds.*], this committee does not deal explicitly with computer ratings, and my rating estimates in this issue are not recognized by USCF, which only recognizes C.R.A. ratings for commercial machines. The only other "official" ratings for commercial chess computers are the "Ply" magazine ratings, which are published by the ICCF, and the WBCA blitz ratings published by Walter Browne.

The 1990 U.S. Open (Jacksonville, Florida)

There were no less than ten computers participating in this year's open, quite a lot considering that attendance was only a bit over 300 of whom about half refused to play computers. Eight were Saitek computers playing for a C.R.A. rating; the other two were PC programs by Don Dailey and myself.

Saitek played four clones each of two models to obtain the 48 games required by the C.R.A. One was the Corona, the least expensive autosensory board on the market, with a revised program but still running at only 5 MHz on the 6502 processor. Saitek's own testing led them to believe it was a hundred points stronger than the old Corona, but its estimated final rating after scoring 25 1/2 to 23 1/2 at the Open is just 2030, a mere 12 points

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above the estimated rating for the old Corona in the last CCR. Whether Saitek will accept the rating and produce the unit or make improvements and try again is not yet known. The Corona twice blundered a pawn within five moves (one game went 1 a3 d5 2 Nf3 e5?) due to a flaw in its evaluation, and was often out of book too early. Another problem was that it generally lost when faced with a direct mating attack, a problem common to all the Saitek models of recent years. Its high point was a draw (nearly a win) with former U.S. Champion Arthur Bisguier. Saitek had hoped to surpass the 2100 rating of various Fidelity models, but I doubt that those models would have done any better than the Corona in the same format. Players in a U.S. Open are serious, motivated (both by tournament prizes and by \$50 per win, \$25 per draw C.R.A. incentives), and well rested (1 round a day), while the Fidelity 2100 rating was earned in a 2 round a day private test with much less player incentive, and was actually only 2076 including the preliminaries. In my opinion, Saitek made a major blunder in choosing to run at only 5 MHz. The Corona is capable of running as fast as ten MHz, and at that speed with some modest evaluation and book changes it should earn a high Expert rating in a future test.

The other model tested was the Saitek Prisma, a recently released machine bearing a strong resemblance to the Simultano and the Radio Shack Chess Champion 2150, featuring an LCD board along with the normal pressure board. However, unlike those models, the Prisma does not use the 6502 processor but rather the new Hitachi h-8 chip, running at 10 MHz. This is actually somewhat faster than the Corona's CPU, but because the h-8 comes with much less memory it was not expected to be as strong as the Corona. A 1950 rating was forecast, and indeed the estimated final C.R.A. rating after a 23 1/2 - 24 1/2 score is 1953. Due to the small memory the Prisma's opening book is small and often got it in trouble, but its tactical play was quite respectable. Some players felt that given equal opening books the Prisma was stronger than the Corona, and while I would not go that far, it seems to me that the middle game strength of the two models is rather close. The Prisma costs Saitek less to make than the 6502 models, since it is a "single chip" model (the 6502 units require external ROM and RAM), and if the retail price reflects this the Prisma could be a stiff competitor for the Fidelity Designer 2000 and 2000 Display. It seems likely to me that Saitek will make a strong model using the h-8 with added memory; perhaps they will phase out the 6502. Neither of the two models tested utilized any programming by the Spracklens, now working on a RISC module for Saitek, but perhaps they contributed advice.

Of the two PC programs playing, one was the commercial program "RexChess" (version 2.30) playing under the name "RX21", while the other was a new, still incomplete "C" language program, also by Don Dailey and myself, playing under the name "RX2". The hardware used was a 486 computer at 25 MHz and a 386 at 33 MHz. Neither program made use of more than the standard 640K RAM.

RexChess made a score of 8 points out of 12 and earned a performance rating (C.R.A. formula) of 2318, while the unfinished "C" program scored 7 points and a 2215 performance. We were quite pleased with the C program's results, because it could not yet think on the opponent's time, had no knowledge of isolated, backward, or passed pawns, and was being debugged and revised throughout the tournament. We expect this program when complete to surpass Rexchess. For Rexchess, the high point was a well played draw with I.M. David Strauss. We would have liked to have gone for a C.R.A. rating for Rex, but the total cost of this undertaking would have exceeded our profits to date on Rex! Also, since I was the supervisor of the C.R.A. tests, I could scarcely have supervised the testing of my own product.

In the U.S. Open /WBCA Blitz tournament, two computers participated. Saitek played its "Blitz" board, which has the same program and speed as the Prisma, and scored 9 out of 16 for a mid-master result, well in excess of the rule-of-thumb that computers play a class better at blitz than at slow chess. RexChess (on the 486) scored 11 1/2 out of 16, earning a performance rating (C.R.A. formula) of no less than 2668!! Rex scored 7 1/2 in its twelve games with grandmasters and I.M.s, including 3 out of 4 against Soviet stars Timoshenko (formerly a second of Kasparov) and Yudasin (rated nearly 2700 USCF). Rex's final round win over Yudasin cost him first place, which then went to Max Dlugy. In other blitz games outside the tournament, Rex came out ahead of grandmasters D. Gurevich and Arthur Bisguier, but did poorly against grandmasters Dzindzichashvili and Joel Benjamin. Needless to say, such spectacular results could not have been achieved on an ordinary AT (never mind an XT), nor would they have been possible without an allowance for operator time (3 1/2 minutes). Our thanks go to TD GM Walter Browne for allowing us to play and for the fair operator time allowance (we still overstepped once but would have lost anyway). We offered a \$10 bonus to anyone who won his two game match with Rex in the tournament, but no one was able to do so!

I would like to add a note regarding our plans for Rex and the new "C" program. Rex has achieved a good playing strength, has a good appearance, and has many interesting features, and is enjoyed by several hundred people who have purchased it from ICD Corp., its principal distributor. However we are not able to try to mass market it as is, for several reasons: It lacks color and mouse support, has some minor feature bugs, and it acts sluggish and is prone to malfunction on slow (4.77 MKz) PC/XT machines unless the user is careful to delay move entry a few seconds. We could patch up these problems one by one, but instead have chosen to write an all new program that will not have these problems and will ultimately be stronger than Rex, since we learned a great deal from working on Rex. Although the new program is in "C", which is perhaps twice as slow as assembly language used in Rex, we are rewriting the most critical portions of the "C" program in assembly language to

recoup the speed. While Rex is very similar to the Novag Super C in its play (Novag purchased the Rex "rulebase"), the new program is more similar to the Mephisto Polgar in its search and evaluation, but unlike the Polgar it has hash tables. The new program is already comparable to Rex in tactical problem solving, and should be superior positionally once the necessary chess knowledge has been coded. Whether the new program will be marketed by mail order, in stores, or both is not yet known, but if I have any say in this I will ask that it be offered to RexChess purchasers for a sharply reduced price. While the chess play should be completed soon, it may take some months to add the features and to deal with compatibility issues. Since the new program is in "C", it is quite possible that we will also do a Macintosh version and perhaps others. We intend to continue to improve the strength of our programs indefinitely, and have three powerful computers testing different versions out every night towards this goal.

How Thinking Time Affects Playing Strength

In past issues I have dealt with the relationship of processor speed to playing strength, concluding that in general each doubling is worth about 75 points in the Expert range. At higher levels this figure gradually tapers off to perhaps 50 or so in the Senior Master range. This time I will address the related but somewhat different question of how changing the time limit (or "level") affects the playing strength of a given model.

In principal, there should be no difference between doubling the search time and doubling the processor speed. For example, a 5 MHz Mephisto Polgar set at 40 moves in four hours should play the same moves as a 10 MHz Polgar set for 40 moves in two hours. As long as the human opponent continues to adhere to 40/2, you would expect his results to be the same in the above two situations. But this is not correct, for it ignores the fact that both players, human and computer, think on the opponent's time. Because of this, a time handicap is not as severe as it seems, as anyone who has taken time odds like 5-1 or 10-2 from a stronger player can attest.

Let's try to analyze this problem quantitatively. The way most computers think on the opponent's time is this: they assume he will make the move the computer previously computed to be the opponent's best move, then they start their analysis from that point. I will assume that the computer correctly predicts its opponent's move one-third of the time, roughly what I have observed in practice. This means that on average the computer gets one-third value for its opponent's time. Now suppose two computers are playing each other, but one is allowed 30" per move while the other gets 60". The total effective thinking time for the first computer is then $(30 + 60 * 1/3)$ or 50 seconds per move while the second computer gets $(60 + 30 * 1/3)$ or 70 seconds per move. So what looks

like a two to one ratio is in fact only a 1.4 to one ratio, roughly the square root of the nominal ratio. This in turn implies that doubling the time limit is worth just about half as much as doubling the processor speed. Of course this analysis would need to be modified if it can be shown that humans benefit much more (or less) than computers from their opponents' time, but this is not obvious. There is, however, one exception: if the time limit becomes so slow that fatigue or boredom becomes a factor, then clearly the human will no longer benefit from the computer's time, and the computer's benefit from the long think will be more than the above estimate, although still below the full value of a speed-up.

Suppose we start with a computer of USCF 2200 level, roughly the strength of today's top models in the \$500 vicinity. This assumes both sides play 40/2, or an average of 3 minutes per move. Now let's double the computer's time nine times, to 1536 minutes per move, or 25.6 hours, so it will move about once a day. How well should it play? Based on the table on P.15 of the last CCR quarterly, nine doublings in processor speed should add about 500 points, so nine doublings in the time limit should add at least half of this, or 250 points. This means that if the human could be at the board 24 hours a day and maintain full concentration while still adhering to a 40/2 time limit, the computer should perform around 2450. Realistically, if we assume the human spent say an hour a day at the board analyzing on the computer's time, while still playing 40/2, the computer's effective rating would rise further to somewhere between 2450 and 2700, perhaps 2550 or so. This seems realistic to me under the described circumstances.

Does this mean that commercial machines play like grandmasters in postal chess? Far from it! The key point is that all of the above calculations assume that the human is under a time constraint of 3 minutes a move, as opposed to the 3 days a move of postal chess. There is not much data to base a judgment on how much better human players play postal chess compared to tournament chess, but for serious postal players who put many hours of analysis into each move I believe the difference is very great. When Hans Berliner was World Correspondence Champion he told me that he was convinced that the level of play in that event was far above the level of play in any over-the-board World Championship, even though the players involved were much weaker players. Since his over-the-board rating was around 2400 while Fischer's was around 2800, his claim (which I believe) implies that a human can play 600 or more points better in postal chess than in OTB. This suggests that even though computers play much better in postal than in over-the-board play, for humans the gain should be even greater (if they take it seriously), so the effective rating for the computer would probably be lower in postal play than in OTB. This makes sense, since the longer the time limit, the greater the importance of strategy versus tactics and so the computer's weak point is more apparent in postal play.

As evidence for this theory, I cite a recent two game postal match between IM Mike Valvo and Deep Thought. While Valvo is a very strong player, his rating was well below that of Deep Thought and he would have been considered an underdog at 40/2. Yet he won both games, although not without a lot of hard work.

Another factor that needs to be considered is memory limitations. All commercial chess computers have some limitation on how deeply they can search, due to limited memory. Except for the very cheapest models, this limit is generally set high enough to be unreachable at tournament time levels except in a very few pawn endings (I saw the Portorose 68030 reach its 30 ply limit in such an ending in its CRA test, but it was more than sufficient to see the win). In overnight analysis, a computer is far more likely to reach its limit, but for the better models this is still a very minor factor. Even a sub \$100 machine like the Marco Polo can search 12 plies deep, more than it can expect to search in 24 hours in all but simple endings. In sum, memory limitations need not be factored into the above analysis for most models.

Now let's move the other way. Many people lack the time or patience for 40/2 chess and set their computers to faster levels. If they have bought a machine well above their own level (as they should--I recommend at least 300 points above), they may choose to play 40/2 themselves while setting the computer for say 60/30, a six to one time handicap. This should weaken the computer by around 200 points if we don't consider the effect of thinking on each other's time, but as explained above we should divide by 2, which gives only a 100 point reduction. The conclusion is that time handicaps up to 6 to 1 do not weaken the effective strength of your computer unduly and are therefore very suitable for conserving one's time. Larger time handicaps may be necessary to give ordinary players a chance to win against a good computer, but the further reduction in game time is a small percentage. On the other hand, stronger players are apt to want to play faster games with the computer on equal terms, and here experience has shown convincingly that the faster the game, the higher the performance of the computer, as the game becomes more tactical and the deterioration of the computer's play with short time is not as marked as the humans'. The Mephisto Mega IV Turbo (18MHz) got a CRA rating 150 points higher in Action chess (game/30) than it did at 40/2 in the same tournament after 48 games of each. For other models the gap is probably not quite so large, but in nearly every case computers have done better at faster time limits. For a rule of thumb, most computers will perform about a hundred points better in Action chess than in 40/2 play, and will perform yet another hundred points better in blitz (as long as they are allowed adequate operator time). As evidence, the Mephisto Portorose 68030 has performed around USCF 2400 at 40/2, over 2500 at action, and over 2600 at blitz in various events. There are some computers, both micros (notably Saitek 6502 models) and giants (including Deep Thought and HiTech) which are simply not designed to play well in blitz, and for these the rule is not

applicable. Also it should be noted that slower, weaker models suffer more from short time than the fast ones, so if you own an old or very cheap machine you may actually find it easier to defeat at fast time limits than at slow ones. Finally, it must be noted that there are a few human players who play nearly as well at short time limits than at long ones, and of course they may do better against computers at short time limits than at 40/2. But experience shows that such cases are rather uncommon.

Fidelity Review

Not much is new from Fidelity lately, now that the Spracklens have gone over to Saitek. The high-priced Elite Version 10 with a 68040 processor is still not out. The only new product of note is "Chesster", which is basically a Designer 2100 (no display) with a voice chip added. Unlike earlier talking models, this one has enough vocabulary to be of some interest. In normal mode, it makes sarcastic and amusing comments, although the variety is rather limited. At least the comments bear some relationship to the game. More importantly, it has a coaching mode for novices which will warn them that a proposed move would lose a knight or pawn, for example, and even will explain the basic moves of the pieces. It also has a mode that will assist you in correct operation of the machine, for example telling you which square to push down on, etc. These features make it a good learning tool for young children. Of course the strength of the machine is far too high for this purpose. Presumably it is intended for competent adult players with young children learning the game. It has novice levels, but even its lowest level is too strong for a true novice. Still, if the level were made very weak, it would not be a good coach. The actual chess is the same as the old Par Excellence, but with a variety book replacing the narrow optimized one of the Par. Strictly speaking it should not carry a C.R.A. rating due to the non-focused book used by the Par, but in any case it is over 2000 strength and a good novice teacher.

As for the Elites, test results have improved a bit for the Version 5 (with two processors), and it is the strongest wood model under \$1000. I feel that it is a better buy than Version 6, which costs much more but is only a little stronger. Fidelity has just received 68040 processors and plans to make some Version 10 units in October. Since reports on the relative speed of the 68040 and 68030 vary widely (some say 2-1 at same MHz, others 3-1 or more) I can't say yet whether Version 10 (at 25 MHz) has a chance to rival Portorose 68030 (at 36) for the top spot on "Ply" and other rating lists. If 3-1 is correct, then Version 10 might emerge on top, but I strongly suspect that the truth (for chess) is near 2-1, in which case Portorose 68030 will still be king.

The Mach III Master and the Designer Mach III continue to be the best values in terms of strength vs. price in the 2200 and up range, but it should be noted that the defect

ratio of the Designer version is high, and purchasers of the Designer version should insist on buying only machines that have been checked out by the retailer. If you want comparable strength with greater reliability, the only alternative close in price is the Novag Super Forte C, for about \$80 more.

Two older models now on sale and recommended are the 6097 L.A. (Mach II) and the original Excellence. The L.A. remains the only high expert model under \$200, while the Excellence is the only solid class A model under \$80 currently. Despite all the progress in recent years, no other company has been able to make a stronger model than the Excellence for less money.

The Go playing machine "Nemesis Igo Dojo" is now available and is the first of its kind. It is an excellent tool for learning the game and strong enough to beat novices. Its estimated strength of 13 kyu (perhaps around class E in chess terms) seems to me to be a bit optimistic but fairly close to the truth. It has many interesting features and seems to play in a reasonably human like style. My main criticisms (aside from the low playing strength common to all Go programs) are the high price, poor handling of "ko" fights, and the tendency of Nemesis to take too much time in the endgame--a complete game on the full size board takes about 2 hours even if I move quickly. This can be circumvented by reducing the depth or width of search in the endgame, but this of course lowers the playing strength. Those who own a good PC can save a lot of money by simply buying the Nemesis program directly.

Mephisto review

The main new product since our last review is the long overdue Polgar 10 MHz. Perhaps fearing that it would kill the market for the more expensive 16 bit Portorose, Mephisto raised the price of the Polgar 10 well above proposed levels. The Polgar 10 is offered only in the "Modular" board, but in fact it is not modular--the buyer is warned that the use of other modules may damage the machine. The Polgar 10 program is identical to the standard Polgar (5 MHz), but runs exactly twice as fast. This should increase the strength by about 75 points (60 vs. humans) for most programs and appears to be doing somewhat more than this for the Polgar at tournament levels based on the Swedish testing.

Which is stronger, the Polgar 10 or the Portorose 16 bit? The answer seems to depend on the level being tested; the Swedish results so far at 40/2 are somewhat better for the Polgar 10, but in a direct match I ran at 60/30 (reversal method), Portorose 16 bit won by 11-5. Results in British tournaments have been a bit disappointing (USCF equivalent 2160 for 39 games), but this was said to be due to players repeating lines with which others had won--one problem with human testing. Eric Hallsworth in his recently renamed magazine "Selective Search" rates the Portorose higher by a trifling 4 points. I suspect that the Portorose is stronger at a minute a move or faster,

while the Polgar 10 takes the lead at 2-3 minutes per move. The Portorose, even in the same "modular" board, is still several hundred dollars more expensive, but its modularity and ability to retain games when switched off compensate to a degree. I judge the Polgar 10 to be the better buy, but the choice is somewhat subjective. The Portorose has hash tables, a larger program, and a larger opening book, but the Polgar 10 has a faster processor in Mips, by nearly 3 to 2. Both have fine programs; which one is better is a very tough call.

In the last issue, I wrote of the puzzling fact that results in human tournaments were no better for the Portorose 68030 at 36 MHz than for the Portorose 68020 ("32 bit") at 12, despite a 3.6 to one speed ratio and a 4 to 1 price ratio. It now seems that this was partly just a fluke of sample size and/or unequal conditions, since the 68030 model has had several superb results while the 68020 has had both good and bad ones. The 68030 results include: simul victories over ex-world champion Karpov and former candidates Robert Huebner and John Nunn, a 40/2 tournament victory over GM David Bronstein (who missed becoming World champion by 1/2 point in 1951), an IM norm in the Dortmund Open in West Germany, including draws with two grandmasters, and a 7 1/2 to 4 1/2 match victory in action chess (game/30) over the West German team champion, consisting of two GMs, two IMs, and two FMs. All in all, the evidence suggests that the 68030 was rather unlucky to fall below 2400 in its CRA test (2376), just as I estimated in the last issue.

The Portorose 68020, which already had several fine achievements covered in the last quarterly, had one more recently with a 2700 + (!) USCF equivalent result in a 40/2 six round German event. But it flopped badly in the Australian Major open with a performance rating of only 1968 Australian for its 11 games. I don't have much data on the level of Australian ratings but probably this would fall somewhere around USCF 2100. Such enormous swings from event to event confirm the need for large samples and computer vs. computer games. A report on the Australian event concluded that "it would be unwise to place Portorose [68020] in the Expert class, never mind the Master class"; but witnesses to its spectacular showings in France, Germany, Ireland, and Sweden would certainly not agree with this!

The Portorose 68000 has played in very few human events, since operators always like to enter the strongest available model. Its results at tournament time controls in Alabama and Germany have been disappointing, but the samples are small. At intermediate time controls (game/30, 60/1, even 60/2) my results show only a small gap between the 68000 and 68020 Portorose models, but apparently at 40/2 the 68020 takes a big jump in strength due to frequently doing the crucial odd (fifth) full width ply, while the 68000 needs even more time than this to make the jump in strength. So I conclude that if you stick to 40/2 or similar levels the price premium for the 32 bit 68020 is well worthwhile, but if you like the intermediate levels you may want to save money with the 16 bit unless you are wealthy. Incidentally, the Portorose models have

... have some trouble with their batteries going dead, which destroys the ability of the machine to retain games and programmable book when turned off. The problem is currently being worked on. You should ask before purchasing whether you are buying a corrected model.

While Mephisto makes a number of fine machines that sell for under \$500, they are not quite competitive in strength or price with the Fidelity Designer Mach III, although I suspect that they are more likely to remain trouble free for a long time. Mephisto has just released an MM5 module for its three boards. It is somewhat cheaper than the Polgar because only 32k ROM instead of 64k. Since it is a newer program than the Polgar, Mephisto hopes it will be close to the Polgar in strength despite the smaller ROM, but there are no test results yet and I don't have a module yet myself. In the hand-held class, the Mephisto Marco Polo remains the strongest model under \$100, and is recommended.

Ed Schroeder, programmer of Polgar, has reportedly completed a RISC program for the "Acorn" processor, but there is no word on when or if it will be offered for sale commercially, and little evidence yet of its strength. In a 6 round Dutch human + computer event it scored equally with Portorose and Fidelity 68030 models, Fidelity 68020 and Super Forte, above several other strong models. Richard Lang has so far rejected RISC and continues to improve his 68000 family program. In the 1990 London computer olympiad the latest version of the Lang program on a fast 68030 took first with 7-0, while the Schroeder Acorn machine took second at 6-1. Lang, Schroeder, and Fidelity are expected to battle it out in France this fall for the World Micro title. Saitek will not participate since their RISC program will not be ready in time, and a tournament where all entrants are owned by the same company (Hegener and Glaser) cannot be of much interest, I fear. Perhaps some pc software entrants will give the event some life, although even a 486 computer will not be comparable to the hardware Fidelity and Mephisto are likely to bring.

Novag Review

Although Novag has come out with some new models recently, in particular the "Beluga" and "Super Nova", they are not currently on sale in the U.S. and so not reviewed here. The most significant news concerning Novag is a sharp rise in the Swedish rating for the new Super Expert (and Forte) C models, together with the fact that prices have not risen as sharply as we feared in the last review. The Supers appear to rival the Mephisto Polgar for the title of "World's strongest 8 bit program", and since they run at 6 Mhz vs. the Polgar's 5 and are less expensive on comparable boards ("Expert" vs. "Exclusive"), the Super Expert C now warrants a best buy label as long as it stays below \$600. Of course the Polgar 10 is stronger, but it costs more, is smaller, and is not wood. As to comparing the Super Expert C to the Fidelity Elite Version 2, over a range of time limits they are too close to call, so the lower

price of the Novag gives it the edge. Considering the large hardware advantage of the Elite (both processor and memory), the advantage of selective search over full width is becoming rather obvious. The Super Forte C (same program as Expert) remains overpriced vis a vis the Fidelity Mach III Master and the Designer Mach III, but I believe the Novag unit is better made than the Designer version and less likely to need repair.

The Super V.I.P. has now dropped to only ten points over its rival Mephisto Marco Polo on the Swedish list (31 points on Hallsworth's list), but the price gap has also dropped, so both units remain best buys in the hand-held category.

The Mentor 16, a cheap table model thought to be in Class B, was tested by one of our readers whose results suggest that Class C would be more correct. He also reports that it could not mate with rook or even queen vs. king. If you must stay under \$100 and want a decent table-top model, look for a discontinued Novag Quattro or Primo, or Fidelity Excellence.

As far as I know, Novag has still made no decision to begin work on a 16 bit or better program, and so will probably not remain competitive for upper end models much longer. I feel that this is a waste of the talents of their programmer Dave Kittinger, who could surely produce a Senior Master machine given a powerful CPU in the 10+ MIP range and enough time to work.

Saitek Review

The most interesting new development with Saitek is the new line of single chip computers based on the Hitachi h-8 chip, including the "Blitz" and "Prisma". In the past, Saitek's single chip models used the 6301 and were too weak to be of much interest to serious players, but with the much superior h-8 they were able to earn a C.R.A. rating estimated at 1953 (see U.S. Open story for details). An 8 game match conducted by Raymond Yeo at 1 minute/move level in which the Prisma defeated the Novag Super V.I.P. by 4 1/2 to 3 1/2 is consistent with the C.R.A. rating. Early pricing estimates (\$199 retail) are rather high for a single chip model, but if the Prisma becomes available for under \$150 it might be deemed a good value in view of its many features, including the LCD board. The Blitz is unique in that it operates by turning screws rather than pushing buttons, but I can't say whether this is an advantage or not. At an estimated \$250 retail, the Blitz will be by far the cheapest autosensory unit on the market. The Blitz and Prisma share the same program and speed, so presumably the C.R.A. rating will ultimately be awarded to the Blitz as well. One point to note about these models is that while Saitek programs in the past have been notoriously weak at fast time limits, this does not seem to be the case with the h-8 models. Indeed, while the Prisma is no match for the new Corona at slower time limits, it wins decisively in blitz chess.

In the mid-range, the Corona is a very well-made, reasonably priced autosensory board, but unless a ten

MHz version comes out it will not be a rival for Novag Super Expert C in terms of strength. The Saitek 6502 programs seem to need a fast processor more than most programs, and so I feel that a Corona 10 MHz would deserve consideration if under \$500.

As for the top of the line, the Maestro D module for the Galileo board does seem to be a clear improvement over earlier programs, and at its top speed of ten MHz it is a strong Expert, but it looks like Saitek will not have a master level module until the switch to a new processor is made. This could be the h-8 with external memory added, a 286 or 386 program, or for more money the RISC module that the Spracklens are working on. One way or another, Saitek should be a real rival for Mephisto and Fidelity in 1991 as regards the high level market.

One point of correction from the last quarterly: Kathy Spracklen pointed out that although they are working on a SPARC station, this does not necessarily imply that the actual RISC module they produce will run on a SPARC chip -- there are several other likely candidates within the RISC family.

CXG and Others -- Review

In the last issue I reported on the CXG Sphinx program, offered in various boards (Dominator and Galaxy are pressure boards, Commander is autosensory). I recently tested a new model, but I regret to say that it still has a bug (reported last year in "Modul" magazine) that causes it to blunder its queen in certain situations. Also, it is still being produced at the non-competitive speed of 4 MHz. I feel that the program has good potential, and CXG prices tend to be more reasonable than others, so I urge CXG to fix the bug and offer the models at a decent speed, perhaps 8 Mhz. If a Dominator with these changes becomes available for under \$250, or a Commander for under \$400, they would be best buys and highly recommended. A bug-free Dominator at 8 MHz should be about as strong as the Mach III.

I have received no further word on the planned h-8 program. No other manufacturers have any new models of interest in the U.S. to my knowledge. However, one new product, "The Final Chesscard", rates a mention. It is neither a chess computer nor a PC program, but is a card to be inserted into a PC or Commodore for playing chess on that machine. It contains its own processor (5 MHz 6502) which supersedes the CPU of your computer. This enables it to play much better than any Commodore program, and perhaps as well as a good PC program on an old 4.77 MHz PC/XT. A 6502 at 5 MHz is actually comparable to a typical (10 MHz) AT in raw speed, so the idea makes sense, but unfortunately the "Ply" testing shows the "Final Chesscard" to be much weaker than the best 6502 programs. Still, at a "Ply" rating equating to over 1900 USCF it offers good value for Commodore owners, but the PC version is overpriced and not competitive with good software on all but the slowest PC's. For AT owners, it would be ludicrous.

Rating The Commercial Chess Computers

Since the last quarterly, there have not been many new models rated, but we do have considerably more data, especially from Sweden. The Polgar 10 MHz did earn a very impressive "Ply" rating (40/2), well above the Portorose 16 bit and the Elite Version 5, but when I played the Polgar 10 against them at 30" with selected/reversed openings the Portorose won by 11-5 and the Elite by 8 1/2 - 7 1/2. The Novag Super C models have risen sharply in the "Ply" ratings, while the Portorose 68030 has shed some of its huge lead over its baby brothers.

One new addition to the rating lists of "Ply" and Eric Hallsworth in England is the pc program RexChess, running on a 20 MHz 386 computer. Since I am co-author, it would be a conflict for me to test/rate the program myself, so I will content myself with quoting ratings from Ply and Hallsworth (as adjusted to U.S. levels). "Ply" has nearly enough games on a 33 Mhz 386 with Rex to add it to the list separately on that hardware; at last word it was running about equal to the Fidelity Mach IV. Interestingly enough, Rex turned in a performance rating at the U.S. Open only 7 points shy of the Mach IV's 2325 C.R.A. rating.

In past lists I have advocated compressing computer vs. computer rating differences by 20-25%, and I am using 20% this time, but there is now considerable evidence that this adjustment is needed only for USCF ratings, not European ones. It seems that the spread between USCF and continental European national ratings is now about 200 points at USCF Expert levels, but only 100 at I.M./G.M. levels. I suspect that at USCF class C levels the gap may be around 300 points, but this is only a guess. Due to arbitrary floors and past bonus policies, the amount of USCF inflation is higher at lower levels, and so our ratings are compressed by perhaps 20% relative to European ones.

One point that I have neglected in the past is the question of whether the 75 points per doubling of MHz rule applies to comp vs. comp ratings or to human ratings. To answer this question, let's consider all cases where the same program appears on the "Ply" list at two different speeds. The Turbostar program gained 84 points for a doubling, the Excellence gained 43 for a 4/3 speedup, Conchess Plymate 5.5 MHz gained 39 for a 3 to 2 speedup over MM2, Meph. Amsterdam gained 50 points for a 3/2 speedup over Psion Atari, Meph. Dallas and Roma gained 45 and 58 points for a 2.3 speedup from 16 to 32 bit, the Polgar gained 97 for a doubling, the Mach IV gained 87 for a 2.3 speedup over the Mach III, the Almeria 32 bit gained 76 for a 1.8 speedup over the 16 bit, and the Portorose 68030 gained 201 for a 6.4 times speedup over the 68000 version. Combining all this data by multiplying the speed ratios and adding the rating increments gives us a net gain of 780 points for a 1682x speedup, which works out to 72.8 points per doubling. A

similar calculation based on Eric Hallsworth's list gave 77.8 per doubling, so we can say that 75 is a fair value for computer vs. computer ratings. But since we have already decided that comp-comp rating differences need to be shrunk by 20% to predict USCF ratings vs. humans, it follows that a doubling in speed is only worth 60 USCF points against human opposition. I therefore suggest that anyone using the table of p. 15 of the last quarterly should multiply the adjustments by .8 to get realistic USCF rating differences as they would apply to human opponents. Note that the value of a doubling appeared to be only slightly higher for the older, weaker models than for the strong ones. This is very encouraging for the future of computer chess; it suggests that each future doubling of processor speed will bring only a little less gain than the last one. With the Portorose 68030 now about 500 points below Kasparov (2400 USCF vs. 2800 FIDE + 100 USCF-FIDE gap), if the future doublings are worth 50 points we "only" need ten of them, or a factor of 1000x, to reach the champ's level. Assuming that the opening book and hash table size are also upgraded by a similar factor, this might

Computer	MHz	CCR free	CCR 30" reversal	Hallsworth adjusted	Mean rating
Meph Portorose 68030	36	(2422)	(2391)	2402	2405
Fid Elite 9 68030	32	(2320)	(2360)	2326	2335
Meph Portorose 68020	12	2322	2291	2325	2313
Meph Almeria 68020	12	2284	2288	2285	2286
Fid Elite 6/Mach 4	20	(2270)	(2310)	2274	2285
Meph Portorose 68000	12	2299	2279	2274	2284
Fid Elite 5 (2x68000)	16	(2240)	2239	2238	2239
Novag Super Ex/Forte C	6	(2320)	(2207)	2191	2239
Meph Polgar 10	10	(2240)	2199	2271	2237
Meph Roma 68020	14	2248	2238	2222	2236
RexChess on 80386 PC	20	****	****	2234	2234
Meph Almeria 68000	12	2268	2304	2214	2224
Meph Dallas 68020	14	2214	2254	2205	2224
Fid Elite 2/Mach 3	16	2199	2240	2194	2211
Meph Academy	5	2265	2198	2158	2207
Meph Roma 68000	12	2225	2142	2161	2176
Meph Polgar	5	2177	2146	2196	2173
Novag Super Ex/Forte B	6	(2150)	(2230)	2138	2173
Meph Mondial 68000 xl	12	2176	2164	2164	2168
Meph Amsterdam	12	2160	2155	2140	2152
Meph Mega IV	5	****	****	2138	2138
Meph College (S.M.2)	4	2126	2127	2149	2134
Fid 6097 Mach II L.A.	12	2129	2107	2137	2124
Meph MM4	5	2102	2141	2117	2120
Saitek Gal. Maestro D	10	(2097)	****	2138	2118
Novag Super Ex/Forte A	6	2153	2076	2111	2113
Novag Super Ex/Forte A	5	(2135)	2084	2065	2095
CXG Sphinx Dominator	4	****	2063	2088	2076
Fid Des. Display 2100	6	(2060)	2082	****	2071
Fid Excel 68000 B	12	2081	2066	2063	2070
Saitek Gal. Maestro C	8	(2040)	(2065)	2088	2064
Fid Chesster	5	(2044)	(2065)	****	2055
Computer	MHz	CCR free	CCR 30" reversal	Hallsworth adjusted	Mean rating
Novag Expert	5	2051	(2050)	2060	2054
Novag Forte B	5	2025	2062	2047	2045
Fid Des. 2100/Par Ex	5	2044	2022	2045	2037
Novag Forte A	5	2028	2033	2040	2034

be fairly realistic. With substantial program improvement, perhaps only 7-8 doublings might do the job.

This issue I have used Eric Hallsworth's list (which includes all the "Ply" results) rather than the "Ply" list itself for the sake of variety. Because Eric's list covers 1, 2, and 3 minute games it has larger samples than "Ply". I add 84 points to his figures (the BCF-USCF conversion recommended by "Ply"), then add or subtract 20% of the difference from 2200 (as discussed above). I have included many older models this time so that readers can measure the progress of the past few years. As always, numbers in parenthesis are adjusted for speed differences.

As for my own lists, the overall level is tied to those models with C.R.A. ratings earned in major tournaments. The list has therefore dropped slightly from last time due to the dropping of the old private C.R.A. tests with their somewhat inflated ratings. My free style list covers 1, 2, and 3 min. levels and is 20% contracted; my 30" reversal list uses 8 preselected openings and is 25% contracted due to the shorter time limit. I then average my two ratings with Hallsworth's to get the final rating, listed as "mean".

Saitek Stratos	5.6	2022	****	2040	2031
Conchess Plymate	5.5	****	****	2030	2030
Meph Rebel (MM3)	5	1991	2013	2046	2017
Sait Simultano/Corona	5	1997	2008	2015	2007
Fid Des. Display 2000	3	(1994)	(2018)	****	2006
Novag Super Nova 6301	16	****	****	2000	2000
Fid Des. 2000	3	(1994)	(1972)	(2001)	1989
Fidelity Excellence	3	1960	1993	1990	1981
Final Chesscard for PC (contains 6502 chip)	4	****	****	1976	1976
Nov SuperConstellation	4	1954	1964	1970	1963
Saitek Turbo King	5	1950	1896	2026	1957
Sait Prisma/Blitz h-8	10	1961	(CRA 1953)	****	1957
Novag SuperVip (6301)	10	1926	1969	1940	1945
Radio Shack Champ 2150	3	(1947)	1874	(1976)	1932
Fid Excel Display	3	1909	1927	****	1918
Novag Quattro	4	1892	1891	1908	1897
Meph Europa/Marco Polo	8	1846	****	1915	1880
Novag Primo/VIP (6301)	8	1827	1883	1900	1870
CXG Adv. Star(6301)	8	****	****	1846	1846
Sait Galileo (no Mod)/ Turbo S 24k (6301)	8	****	****	(est1770)	1770

For those who prefer to go by results in human tournaments, I again include an updated list of those results over the past four years in the seven nations whose rating levels were compared by "Ply". Minimum sample size is 48 games, minimum time limit is 2 minutes per move.

Mephisto Portorose 68030 = 2408, Mephisto Portorose 68020 = 2398, Fidelity Elite 6 and Mach 4 = 2308, Mephisto Almeria 68020 = 2270, Mega IV Turbo (18 MHz) = 2226, Fidelity Mach III = 2222, Mephisto Academy Turbo (18 MHz) = 2197, Meph Academy (5 MHz) = 2177, Mondial 68000xl = 2170, Meph Dallas 68020 = 2162, MEGA IV = 2162, Fid 6097 LA = 2150, Novag Super Expert (A,6 MHz) = 2117, Novag Forte B (5 MHz) = 2110, Saitek Maestro B / Stratos = 2096, CXG Dominator (4 MHz) = 2070, Par Excel/ Designer "2100" = 2029, Novag Forte (original) = 2012, Saitek Maestro D 8-10 MHz 2009, Saitek Prisma = 1953. Only the Portorose 68020 figure is seriously out of line with comp-comp testing, and it would be somewhat lower with the inclusion of a poor result in Australia, not among the seven countries surveyed. These numbers offer strong support for the validity of comp-comp testing.

Features in Commercial Chess Computers

Playing strength is the number one concern of many chess computer purchasers, and rightly so to a point. But once the machine out-rates the player by 300 to 400 points, the advantages of increasing the strength further are rather small to the owner, since he will probably usually lose even with a sizable time handicap. With several affordable models now around the 2200 level, this means that players under 1800 strength should pay more attention to features in making their choice among the 2200 level models.

Most of the really important features are now standard in nearly every machine over \$150. The single most important feature in my opinion is a display, which can communicate such useful information as best line of play, evaluation of position, and time taken per move or total and also some less useful information like depth of search and nodes per second. If you want to learn from your machine, don't consider a unit without a display. This rules out several machines in the under \$150 category such as Mephisto Europa, Fidelity Chesster, and many older models, but above that price you can expect a display. The maximum depth of the best line of play displayed is four on most Fidelity models with a display and on the Mephisto Polgar, 3 on the CXG Sphinx models and 11 (!) on Mephisto Portorose; however I see little point to going beyond 7 or 8, as the analysis is usually very superficial at great depth. The Polgar has the nice feature of also evaluating your last move as well as the position. Nodes per second or total are displayed by Novag, Fidelity, and Saitek models, but not CXG or Mephisto; this is of interest only as a curiosity.

One feature of interest to the serious player is a programmable opening book, offered by the more expensive models with permanent memory (Novag Supers, Fidelity Elite, Mephisto Portorose, Saitek Corona/Maestro). If you want to practice certain openings, this can be a nice feature; of course you can always use "memory" or "player-player" mode to input a certain line, but it's not quite the same. Players below class A or perhaps B are not likely to have the opening knowledge necessary to make effective use of this feature.

Now a word about levels. Nearly every machine over \$100 has all the levels you will ever need, and then some. Some of the older models don't have game/30 or /60, but this has become standard. An analysis level, where the machine thinks until interrupted or until it finds a mate or reaches maximum depth, is also nearly universal now. Most models also have especially weak levels for novices;

the Novag and Saitek models seem to have very "good" (meaning very weak) novice levels. Even a normal 1 ply search, the weakest level on several Fidelity models, is far too strong for young children; Fidelity "Chesster" compensates by warning the player when he makes a blunder and asking him if he wants to retract the move.

Some new models (Fidelity Elite, Meph. Polgar, and RexChess for the pc) have a rate your play feature. Many people seem to have the misconception that the programs attempt to rate the quality of your moves; in fact all they do is rate the results using the USCF performance rating formula, based on an estimated rating for the machine at a given time limit. Of course you can do this yourself easily enough if you know the formula (computer rating + 400*(wins -losses)/number of games played)and the estimated computer rating. Foreign models (Mephisto) presumably calibrate their ratings to European levels, so Americans should add 100-200 points.

One very nice feature found in the Novag Supers and the Mephisto Portorose is that you can replay a game afterwards and get instant analysis of every move played. This is a very useful learning tool, and a great help for annotating games!

While on the subject of replaying games, nearly all models over \$150 can replay the entire game for you, while the cheaper ones generally cannot. The Mephisto Europa and Marco Polo and the Novag and Saitek models under \$100 can only remember the last 10 or 8 plies of the game, which also means that they cannot detect draws by 50 move rule and some repetitions. This is because of the extremely tiny RAM in those models, 1/4 K or less. Usually such small RAM models play rather weak chess, but somehow the Europa/Marco Polo manages to play at class A level despite this serious handicap.

There are a few features found only in one model or group of models. The Saitek Simultano can play 8 games at once, which might be of use in a school setting where the faculty chess club advisor is apt to be too weak a player to teach the kids much himself. Still, I cannot imagine that the demand for this feature could justify its cost. The Fidelity Elites have the "learning" feature, whereby they attempt to vary their play if you repeat a game you won (or should have won). This is an often requested feature, but some people may be disappointed to realize that the learning is specific to an exact position; if you change the position of a single pawn it will repeat the same errors. I expect that Mephisto will soon add this feature to their top line models. Fidelity Chesster is the only model that uses a voice to point out your blunders, call out your moves, or simply insult you. Saitek Simultano and Prisma and the very similar Radio Shack Champion 2150 have an LCD board which allows you to make sure that the position you have on your board is the correct one. While this is not important to a skilled operator, I believe that a great many users of pressure boards have difficulty getting through a game without making one or more computer moves incorrectly or even

mis-registering their own moves. If you are one of these many people (and I have even known masters to whom this applies) and cannot afford autosensory models, consider these models. You will really appreciate the LCD board. The Mephisto Portorose (and at the other end of the scale the CXG Advanced Star Chess) offer a choice of playing styles; there is a real difference in the styles, but the difference is not so marked as to be a significant factor in your purchase decision. Most people will want to use the Portorose on the recommended, default level. The Novag Supers and Mephisto Polgar offer a choice of selective depth, or even full width; this also amounts to a choice of styles, since reducing the selective depth will make the computer more alert to sacrificial possibilities but will weaken its play in most positions. Also there is some suspicion that the correct amount of selectivity is dependent on the level, though this is still under investigation.

Autoplay, found in the top end models of Mephisto, Fidelity, Novag, and Saitek (and RexChess), has various uses. It can be used to see how a certain game might have continued, to adjudicate a position, or, at least with Novag, to run games between different selectivity settings at various levels to determine which settings are strongest at which levels.

Some models (most Fidelities, Novags, and Mephisto Polgar) offer a choice of tournament or wide book. This is a good idea, because the tournament book does not offer enough opening variety for the average user, but the wide book is not usually thorough or deep enough for use in actual tournaments. This is one of many reasons why many owners feel their machine is not as strong as its rating implies, since they must play it in wide book mode to get enough variety.

Modularity is always a controversial feature. The autosensory Mephisto and Saitek models take modules which can be upgraded simply by sending in the module-Fidelity and Novag have also offered upgrades in the past but only by sending in the whole unit. The Saitek models (Galileo, Renaissance) are designed to accept nearly any kind of module, even a RISC one, but so far no modules except 6502 have been produced. The Mephisto models have been upgraded every year, but the cost of the upgrades is substantial and the improvements have not always been clear-cut (Dallas to Roma was a negligible improvement). In sum, modularity is a plus, but I would not recommend paying too much extra for this feature; after all you can never tell which company will suddenly take the lead in computer chess.

There are several features that come under the heading of convenience. The Mephisto Portorose and Polgar and several Saitek models allow you to retract moves simply by "unmaking" them, without having to hit takeback each time. Most of the better models allow you to return to the start of the game for playback purposes without having to use a hundred takebacks. The Portorose allows you to modify the placement of your men in problem mode without having to do anything more than to move them to the desired squares. Several top models will give a

second best move on demand. Most models will offer a hint on request. Many have teaching features that help you learn the openings. Finally, if you don't even like having to make the computer's move for it, there is always the Fidelity Phantom.

Chess Mips Revisited

In the last quarterly I introduced the concept of comparing hardware used for chess playing by comparing it to the original IBM 8 MHz AT which is defined as 1 "Chess Mip". The precise numbers for different processors depend on the choice of chess program and on the person or compiler translating the program to different processors, but based on my experience with various programs I was able to give some estimates for the popular processors. In this issue I would like to supply some more estimates and to revise some of my initial estimates. I have had the opportunity to run additional tests on more programs, in particular on a "C" language chess program by Don Dailey and myself (intended as a possible successor to RexChess). The advantage of using a "C" program for such comparisons is that the program can be run on a wide variety of processors without any question of human translation ability. The efficiency of the compiler used is still a significant variable, but probably less so than the variation in human programming skill.

Within the IBM pc compatible family, my estimates need only be revised for the 386 and 486 processor. While the 386 offers no advantage over a 0 "wait state" 286 at the same MHz when running standard pc software, it does offer some advantage if the program is written or compiled especially for the 386. Since 386 software should be appearing soon, we should allow for this in our CM ("Chess Mips") estimates. My figures for typical machines are: XT 4.77 MHz 8088 processor 0.25 CM, XT Turbo (9.54 Mhz) 0.5 CM, AT 8 MHz 80286 processor 1 Wait State 1 CM (by definition), AT 12 MHz 80286 processor 1 Wait State 1.5 CM (0 Wait State 2 CM), AT 16 MHz 80286 or 386sx 1 Wait state 2 CM (0 Wait State 2.7 CM). For the 80386 machines, my revised numbers are: 80386 20 MHz 3.8 CM, 80386 25 MHz 4.7 CM, 80386 25 MHz + Cache 6 CM, and 80386 33 MHz + Cache 8 CM. For the 80486 machines (with Cache), my new estimate is 11.4 CM at 25 MHz and 15.2 CM at 33.

For the 68000 family, my estimates still look about right for dedicated machines with no wait states (this includes all 68020 models and all but the older Mephisto 68000s--Amsterdam, Dallas, and Roma, which had 1 wait state). For personal computers using these processors (Mac-Intosh, Atari ST etc.) there may be wait states that would reduce the performance by about 1/6 for each wait state. My CM figures for some 68000 dedicated models are: Mephisto Amst., Dallas, and Roma 1.7 CM, Mephisto Mondial 68000xl, Almeria, Portorose and Fidelity Mach II 2 CM, Fidelity Mach III 2.7 CM. For the 68020 models, divide the

Mhz by 3.6, so the Mephisto Dallas and Roma at 14 MHz were 3.9 CM, the Almeria and Portorose at 12 MHz are 3.3 CM, and the Fidelity Mach 4 and Elite Version 6 at 20 MHz are 5.6 CM. For the 68030, dividing by 3.2 gives 10 CM for the Fidelity at 32 MHz, and 11.3 CM for the Mephisto model at 36 MHz. There is still little data on the 68040, but my best information at the moment suggests a divisor of 1.6, so the expected Fidelity version 10 at 25 MHz would be 15.6 CM, somewhat less than my estimate in the last quarterly.

As for the still popular but fading 6502, we have a complication. The chip itself is quite fast, but it cannot handle enough memory to effectively support hash tables, which makes it unable to compete well with the 68000 and 80286 families when accompanied by large amounts of RAM. Still, I think it is fairest to assess the speed of the processors assuming modest RAM (say 8K, too little for hash tables), treating the speed-up of hash tables as a product of large RAM rather than as inherent to the processor. On this basis, a divisor of 3.3 seems about right, putting the many 5 MHz models (Polgar, Academy, Chesster, Simultano, and many older ones) at 1.5 CM, the 6 MHz models (Super Expert/Forte B and C, Designer 2100 Display) at 1.8 CM, and the Polgar 10 and Maestro D 10 MHz at 3 CM.

A new processor now appearing in chess computers is the Hitachi H-8. It is said to be nearly as fast as the 6502 at equal MHz, so I propose a divisor of 4, putting the new Saitek Blitz and Prisma (10 MHz) at 2.5 CM. However, since these models come with only 1K RAM instead of the 8K considered optimum for a non-hash table program, their effective speed will be less than the chip's potential, perhaps between 1.5 and 2 CM. Similarly, the 6301 chip used in many models selling for around \$100 should have a divisor of about 13 (so the Novag SuperNova at 16 Mhz should be around 1.2 CM and the Super VIP at 9.8 MHz around .75 CM), but many cheaper models have very little RAM and warrant a divisor of 16 or more. Thus the Mephisto Marco Polo and Europa at 8 MHz should be around 0.5 CM.

Data is starting to trickle in on the RISC chips. It now seems that my estimates were probably a bit too high here, although data is very sketchy. Our new "C" program ran at an effective speed of 17 CM on the new IBM RISC system 6000 basic model. At first we were puzzled by this, because IBM claims 27.5 MIPS for the model tested, but these are Dhrystone Mips, which run somewhat higher than our numbers because they are based on a different standard than the IBM AT. Relative to the basic AT, the Dhrystone test puts the IBM RISC model at 20.8, not too far above our observed 17. The remaining discrepancy can be explained by the fact that the program was developed on the pc family and hence is not optimized for a RISC chip. I imagine that other RISC chips will also end up with CM figures around 2/3 of their Dhrystone Mips, which in most cases run somewhat below the MHz. For any RISC chip likely to appear in a commercial chess computer in the next year or two, a CM of about 3/5 the MHz is a good first estimate.

Games Section

White: GM David Bronstein, ex-World Champion challenger in 1951

Black: Mephisto Portorose 68030

Match game, 40/2, the Hague, Netherlands

1 b3 d5 2 Bb2 c5 3 e3 Nf6 4 Nf3 Bg4 (out of book) 5 h3 Bh5 6 g4 Bg6 7 Ne5 Nbd7 8 Ng6 hg6 9 Bg2 e6 10 g5 (Safer was 10 c4) Nh5 11 c4 (This risky tactical play suits David Bronstein's style, but it also suits Mephisto's!) Qxg5 12 Qg4 (the point) Qd8 13 cxd5 Nhf6 14 Bxf6 Qxf6 (not with the knight as 15 Qa4 check wins a pawn) 15 dxe6?! (Safer was 15 Nc3) Qxa1 16 exd7 ch Kd8 17 Qe4 Bd6 18 Ke2! Qxa2 19 Qxb7 Rb8 20 Qc6 Bc7 21 Rc1?! (21 Bd5) Qb3 22 Nc3 Qc4! 23 Kd1? (23 Ke1!) Rb6 24 Qa8 ch Bb8 25 Nd5 Qa4 ch 26 Ke2 Rb2 27 Rxc5 Qxd7 28 f4? (weakening; 28 Rc3 offers better resistance) Rh5 (Why not directly 28.Rxh3!) 29 Rc3 Rxh3! 30 Kf2? (he could resist by taking the rook, then 31 Rc2) Qg4! and white resigned, because after 31 Bxh3, Rxd2 forces mate. An impressive lesson on the danger of playing an open, tactical game against a first rate computer. Bronstein was always known for playing interesting chess, rather than maximizing his results by pragmatic play. Even a grandmaster has difficulty out-calculating a Portorose 030.

White: David Strauss I.M. (2515)

Black: Rexchess 2.30 on 486 computer

U.S. Open, Jacksonville, Fl (50 / 2 1/2 hours)

1 Ng3 Nf6 2 c4 e6 3 Nc3 c5 4 g3 b6 5 Bg2 Bb7 6 o-o Be7 7 Re1 o-o 8 e4 d6 9 d4 cxd4 10 Nxd4 Qd7 (The queen later goes to the more normal c7, but white also loses a tempo with his rook then) 11 Be3 Nc6 12 Qe2 Rac8 13 Rad1 a6 14 b3 Qc7 15 Rc1 h6 16 h3 Rfd8 17 f4 Nxd4 18 Bxd4 e5 (!Strauss) 19 Be3 exf4 20 Bxf4 Qd7 21 Kh2 Re8 22 a4 Bf8 23 Qf2 Qd8 24 Qd4 Re6 25 Nd5 Nd7 26 Rcd1 Nc5 27 Qb2 Re8 28 e5 (!Strauss) Re6 29 b4 Nxa4 30 Qb3 b5 31 cxb5 axb5 32 exd6 Rxe1 33 Rxe1 Bxd5 34 Qxd5 Qd7 35 Qb7 (!Strauss) Qxb7 36 Bxb7 Rd8 37 Rd1 g5 38 Be5 Nb6 39 h4 Nc4 40 Bf6 Rxd6 41 Rxd6 Bxd6 42 hxg5 hxg5 43 Bc6 Ne5 44 Bxe5 Bxe5 45 Bxb5 draw. Although black's position was difficult in the middlegame, Strauss could not find a win in post-mortem and felt that Rex had played quite well.

White: Gildardo Garcia (I.M., Columbia, 2465 Fide, 2531 WBCA)

Black: RexChess 2.30 on 486 computer

U.S. Open / WBCA Blitz Championship (game in 5 minutes)

1 e4 c5 2 Nf3 Nc6 3 d4 cxd4 4 Nxd4 g6 5 Nc3 Bg7 6 Be3 Nf6 7 Bc4 Qa5 8 o-o o-o 9 Nb3 Qc7 10 f4 d6 11 Be2 Rd8 12 Bf3 Be6 13 Nd5 (Rex is now out of book) Qd7 14 Kh1 Rac8 15 c3 Ng4 16 Bg1 h6 17 Qd3 Nf6 18 Rae1 Kh8 19 Nd4 Nd4 20 Bd4 Bd5 21 exd5

a6 22 Re2 b5 23 Rfe1 Re8 24 h3 Ra8 25 Re3 Kg8 26 Qe2 Qf5! 27 Re7? Re7 28 Qe7 Re8 29 Bf6 Re7 30 Be7 Qf4 31 Bd8 b4 32 Ba5 Be5 33 Kg1 Qd2 34 Re2 Qc1 35 Kf2 bc3 36 Bc3 Bc3 37 bc3 Qc3 38 g4 Kg7 (Of course black should win, but we wondered if Rex could find a winning plan in a blitz game. The question was answered very quickly.) 39 Kg2 Kf6 40 Rf2 Kg5 41 Re2 Kh4! 42 Rf2 Qe5 43 Kg1 Kg3 44 Rf1 Qb2 (Rex sees mate) 45 Be2 Qe2 46 Rf3 Kf3 and white resigned.

Bits & Pieces

(Readers' letters and replies)

Charles Culver, Halifax, Nova Scotia, Canada

I would like to see your report run an article that both explains and examines the merits of some of the teaching and training features advertised by various chess computer manufacturing companies ...

While I agree that strength and price are the most important factors on which to base the evaluation of chess computers I would also like to be able to consider some of the following... Would you be able, for example, to run an article which analyzed: programmable opening books, opening tutors, selectable playing styles, rating calculators, computer hook-ups, position evaluation, autoplay, and the ability to analyze ten games in memory or selectively analyze a certain move sequence.

Do in fact these features hold any significance for someone trying to improve his chess game? Are changes in computer programming happening so quickly as to make the investment in an expensive chess computer inadvisable at this time?...

Reply: It is true that every year you wait to buy a chess computer will add 50-75 points to its strength for a given price, but against this must be weighed the loss of a year's use of the machine. If you are young and wait long enough you will be able to buy a GM machine for a pittance, but for most players the machines are already good enough, and even for the others it makes sense to buy what one can afford now and upgrade or buy a new model every 3 or 4 years. The progress will not suddenly stop, but will continue at a gradually declining rate for decades. As for features, most worthwhile ones are already available on the nicer models, and future additions are apt to be mostly gimmicks. An article on features is included with this issue of CCR.

William Miller, Cleveland Heights, Ohio

...I am writing to you now to comment on my recent dismal experiences with Software Toolworks' Chessmaster 2100 for the Macintosh.. To set the mood, let me quote the CM2100 package:

"The BEST Just Got Even Better!!!First we took The Chessmaster 2000 and added 10 Man-Years of work by

our programmers and graphic artists, then we supercharged its brain with the latest, most powerful, chess-playing technology direct from the laboratories of Fidelity Electronics - the foremost manufacturer of dedicated chess computers - developers of the world's only USCF Certified Master-Rated (2325) Chess Program!!!"

Please check my reasoning: The "latest, most powerful" Fidelity program is clearly the Mach III/IV program, rated 2325 in the Mach IV incarnation. Software Toolworks has gone out of its way to quote the 2325 figure, followed by three hysterical exclamation points!!! The Macintosh and Fidelity machines use the same family of processors; one may hope for a direct port. Sargon IV, available for nearly two years, already implements the Mach II LA program; the "latest, most powerful technology" should be something more.

You'll forgive me if I dared hope that the above implies that CM 2100 implements the 1989 Mach III/IV program, at least in the Macintosh version. Silly me.

To determine whether CM 2100 is indeed what Software Toolworks strongly implies, I ran CM 2100 through most of the Pierre Nolot problems [see CCR fall/winter 1988-1989 pp. 53-55 - Eds.]. I used a Macintosh II, modestly (25%) accelerated by an Orchid add-on 32k static RAM cache:

	Pb6	Pb7	Cb3	Cb4	Cb6	Cb7	Cb8	En4	En5
Sargon IV	6"	2'30"	10"	1'7"	22"	6'22"	34"	5"	36"
CM 2100	9"	3'26"	11"	1'22"	27"	10'9"	41"	7"	1'43"

CM 2100's performance is closely correlated with Sargon IV's, though typically lags 10-30% behind on each problem. Inescapable conclusion? CM 2100 is running an algorithm [nearly-ed] identical to that found in Sargon IV, though implements it about 25% more slowly than Sargon IV. Second inescapable conclusion: while Software Toolworks does not actually make direct claims for the playing strength or pedigree of this program, they clearly, I think deliberately, hype this program in a grossly misleading fashion. Given Mr. Kaufman's observations that versions of CM 2100 for non-68000 platforms are likely to be entirely unrelated to the Fidelity programs, Software Toolworks' advertising begins to look fraudulent. I intend to get my money back.

There's more. CM 2100 refuses to launch from my hard drive, has crashed for me 10-15 times in the last 24 hours, makes occasionally wacky, illegal moves following the use of the SETUP procedure employed to run the problem set, provides no easy way of monitoring the best line of play selected without grossly slowing the program (I avoided this penalty in obtaining the above figures), and suffers a bad case of feature obesity which hinders the business of actually playing chess.

In contrast, Sargon IV implements the guts of the Mach II LA program significantly more efficiently, presents a much simpler and, I think, more elegant and intuitive interface and I have never seen it crash. Sargon does have a few quirks, though these are easily avoided...

Reply: It is clear that both Macintosh programs are adaptations of the Mach II program (CRA rated 2188 on

68020/20 Mhz), not the Mach III/IV (CRA rated 2325 on same). The Mach III is vastly faster on some of these problems due to including checking moves in its quiescence search, so there can be no mistake on this point. Based on your timings, the Sargon version should be about 25 points or so stronger than CM. This is in marked contrast to the situation for IBM compatibles, where Sargon is over a hundred points weaker. On IBM, CM uses a Kittinger (Novag) program, while Sargon uses a hopelessly bungled adaptation of the Mach II. I am told that the inclusion of some features (i.e. 3d graphics) left insufficient memory to run the Mach II program properly

As for advertising claims, CM use of the 2325 rating is bad enough, but Sargon (IBM) claims of beating CM 85% of the time are simply a lie, and have been withdrawn under threat of lawsuit.

Mark Talley, Richmond, Virginia

...What effect does letting the chess computer think for an extended period of time do to the strength of play? For example, if the Fidelity Mach II LA were allowed in excess of 20 minutes per move and as an opponent the Fidelity Mach IV was restricted to three minutes per move, which computer would be victorious?

[Reply: without thinking on the opponent's time the Mach II should have the edge, but with it I'd bet on the Mach IV.]

Along the same line there must be diminishing returns in letting the computer think. What would the graph of time vs. move strength improvement look like?

[see page 15 of last quarterly].

Again if Deep thought had 10x the amount of time per move to think would it lay waste to the world champion?

[No, but make it a thousand and I'd say yes.]

Can you correlate time with move quality? On a specific note how much of an improvement in game strength in ELO points might one expect by allowing 24 hrs. per move on his/her chess computer? [See article in this issue on this topic.]...Would the Mephisto Portorose 68030 play a competitive game for a 2650 rated player if given sufficient time to make a move? [Yes, if he plays 40/2; no if he also takes many hours per move.] There was a time when chess was played with no time restriction. If we resurrected those playing conditions, would a chess machine reign as champ? [Of course, because the computer would not move until the human died of old age! But if you assume a time limit of say an hour or a day per move, the computer would rate lower than if both play 40/2.]

Is Something Wrong With My Chess Computer?

I am often asked this question. Whenever a computer performs below its rating against other computers or against humans, or when it makes poor or bizarre moves, the owner is apt to suspect that he got either a defective computer or an inferior model. Most often, this is not the case and the computer was just unlucky or happened to reach positions unsuited to its heuristics. But occasionally there is a real problem, particularly when the purchase was from a retailer who lacks any real knowledge of chess computers. Fidelity machines in particular should be checked by the retailer and customer, because many models are nearly indistinguishable by appearance, and mistakes have occurred.

Fortunately, it is rather easy to test your machine. All you need do is compare the time taken to solve a problem or avoid a trap to a published time for the model in question. In order to make this easy, I am listing the times I clocked for a certain trap on most of the machines of current interest. Just use the monitor or player-player mode to reach the position, then set the level to infinite, hit the "play" or "go" key, and time the interval until the proper move appears in the display or is shown via the "hint" mode if the model lacks a display. Allow a second or two for error in my timing (or yours). Bear in mind that Novag and Saitek machines have some slight built-in randomness, and times on the Mephisto Portorose models may depend slightly on the interval between reaching the position and hitting the play key, since the hash table is filling in the interval. Also, some companies make small unannounced changes from time to time, if they feel they are beneficial. So don't be alarmed at small discrepancies, say under 5%. If your machine exceeds published times by more than 5%, repeat a few times to confirm this. If confirmed, it is still possible that a beneficial change was made that happened to hurt the position tested, but if the slowdown is much more than this there is a distinct possibility that you have a defective machine or the wrong model. If the times match within a percent or two you should assume you have a good unit unless it acts up in other ways, such as illegal moves.

I spent many hours selecting the most interesting and suitable test. I wanted one that will give us some insight into the tactical strength and type of search used by each model. In order that the test be neither too quick nor too slow on standard models I felt that a 6 ply (standard full width count) combination was best. I wanted it to be reached in just a few moves, to make it easy to use for verification purposes, and I wanted it to involve no checks, since checks are counted differently by different programs. It also had to involve a sham sacrifice that wins material, so that the varying evaluation functions of different computers would not be relevant, and had to be a line that would not appear in any known opening book. I rejected one trap after another as not meeting all of the above criteria, and just as I was about

to give up I remembered an old trap in Alekhine's defense that fit the bill perfectly. The moves are: 1 e4 Nf6 2 e5 Nd5 3 d4 Nc6? 4 c4 Nb6?. Now time how long it takes your computer to find the pawn sacrifice 5 d5!, which wins a piece for 2 pawns after 5...Nxe5 6 c5 Nbc4 7 f4 (7 Qd4 is even better but deeper), or 5...Nb4 6 c5 N(b6)xd5 7 a3. Since the capture of the piece occurs on the seventh ply in both variations, most computers will find 5 d5! with a six ply search, since captures are normally tried beyond the stated depth. Indeed, every model I tested did find d5! in at most six plies, although some take less due to attack extensions. Now let's look at the times required, one company at a time. Parens mean that the program was tested at a different Mhz than the model listed, with the times adjusted for the Mhz ratio.

The Fidelity machines, being basically full width, all took six ply. From slowest to fastest, the times are: Excel Display 15'55", Designer 2000 (10'40"), Excellence (3 Mhz, 1986 model) 10'18", Par Excel = Designer 2100 6'24", Excel 68000 (b) 5'45", Designer 2100 Display (5'20"), Mach II L.A. (6097) 2'52", Mach III 1'58". The Designer Mach III was not tested but as it runs 10% faster than the original Mach III it should take 1'47". The Mach IV was not tested but should be about 50". As for the Elites, version 2 should take around the same time as the Mach III, version 5 should be around 1'10", version 6 should be a bit over 50", and version 9 should be a bit under 30". Please allow a little extra leeway on these Elite estimates, as I did not have them available for testing when I wrote this article. Note that the times on all the Fidelity models are in the same order (reversed) as their strength. Moreover, each halving of the time equates to roughly the 75 point expected increment in playing strength, if we throw in a bit more for the improved evaluation of the newer 16 bit programs.

Now for Mephisto. The Portorose 16 bit takes 1'22", the 32 bit takes 51", and the 68030 model (not tested) should take 14" based on its 3.6 to 1 speed ratio over the 32 bit. The solution is found in 4 ply full width, or 12 ply selective. This suggests that its "real" search depth, by normal count, is about 2 more than its full width depth on average, which is probably correct. Curiously, despite the great dissimilarity of the Lang program to Fidelity, the times are in close agreement with the Fidelity models of comparable strength. For comparison, the 32 bit Roma, the last of the no hash table models, took 1'47", confirming that the hash tables doubled the speed of the Lang programs. As for the 8 bit Mephisto models, the Europa/chess school/Marco Polo took 5'30", the MM4 1'49", the Supermondial II/College 1'43", the Academy 1'29", the Polgar (1'16"), the Polgar 10 just 38", and the 18 Mhz Mega IV Turbo only 16". These are good times, and show why the Schroeder programs are so strong relative to their hardware. All of these machines took the full 6 ply, so the good times are not due to extensions but to the pruning of bad moves.

I tested two Novag models, both of which took only 5 ply due to special attack extensions. The Super Expert C

took just 19", while the Super V.I.P. took 1'34". Pruning helps the times on both these models considerably.

I tested three Saitek models. The Prisma took 4'19" for six ply, while the (old) Corona (or Simultano) took just 29" and 3 ply. The experimental Corona tested at the C.R.A. took just 10" and 2 ply, the best time of any model tested.

It is amazing to see this 5 Mhz, 8 bit, low expert model beat out the \$10,000 Portorose 68030 on this problem, but the Corona tends to be superb at certain tactics yet poor at others, especially when mate is involved.

I tested the CXG Sphinx in the Commander board; it took 2'12" and six ply. As it uses the same selectivity and runs at the same Mhz as the Mephisto College, it is not surprising to see the times fairly close.

As for PC software, I ran several programs on a 33 Mhz 386 cache model, the fastest available for under \$2500. On a 33 Mhz 486, these times would be about half; on a 20 Mhz 386 about double; on an 8 Mhz AT about 6 1/2 times as long; on an xt turbo (9.54 Mhz) about 13 times longer; and on an old pc/xt 4.77 Mhz about 26 times longer. Rex 2.3 took 13" (6 ply), CM2100 needed only 5 ply due to the Novag attack extensions but still took 17", MChess (a successor to A.I. Chess) took 21" (4 ply), Zarkov 2.0(c) took 24" (5 ply), and EdChess (one of the better "free" programs) took 1'53" (6 ply). The best time of all was on the old British program Cyrus (12"), but it made the worst time on the second position given below.

I decided to include a second position, this time a mate trap. It is a version of the "George Morris" trap discussed on page 50 of the 88-89 CCR. Input these moves: 1 d4 d5 2 Nf3 Nf6 3 Bf4 e6 4 e3 Be7 5 c3 o-o 6 h4 h6 7 Ng5 hxg5(?) 8 hxg5. Any attempt to save the knight will lead to a simple mate, i.e. 8...Ne4 9 Qh5 f5 10 g6 and mate next. Black can avoid any direct loss of material by 8...Re8, 8...Nbd7, or 8...g6, so the test is to see how long it takes on infinite level to show any of these three moves in its display. While the earlier test favored the selective programs, this one tends to favor full width, or at least only those selective programs that recognize threats of mate. It is also a six ply problem by standard count, but some selective programs take up to 8 ply, while the inclusion of checks in the quiescence search allows several programs to solve it in 5 ply.

The Fidelity Designer 2000 took (5'13"), the 1986 Excellence took 4'12", the Par Excel or Designer 2100 took 3'8", the Designer 2100 Display (2'37"), the Mach II L.A. (6097) 1'31" (all six ply), and the Mach III just 30" for 5 ply. The Mach IV or Elite 6 should take about 13", the Elite 5 about 18".

The Mephisto Portorose 16 bit took 14", the 32 bit 8", the 68030 should take between 2 and 3". The Roma 32 bit took 52". All took just 2 ply full width.

The 32k Mephisto 8 bit programs, and the CXG Sphinx, lack the ability to recognize mate threats in their selective search, and so take 8 ply and a long time on this trap: Mega IV Turbo 18 Mhz 10'30", Mephisto College 1 hour 12', Sphinx 46'. In contrast, the larger Schroeder programs do spot mate threats and perform well: Polgar

(1'20"), Academy 43", Polgar 10 40" (all 5 ply). The full width Europa/Marco Polo takes 6 ply and 7'15".

The Novag Super Expert C takes 6 ply and 1'42", while the Super V.I.P. also takes 6 ply but 3'6".

The Saitek Prisma takes 5 ply but 16'12", the (old) Corona 5 ply and 31', the C.R.A. Corona model 35'. If Saitek can do something about its weakness at mate threat detection, we should see a large jump in strength.

As for the PC programs on the 33 Mhz 386, Rex 2.3 and CM2100 both took 16", MChess took 26", Zarkov 2.0c 74", EdChess 2'25", and Cyrus 2'43".

It should be possible to compare the tactical speed of the various programs by taking the geometric mean of the times on traps such as these, but for reliability we need many more than two positions. Perhaps this will be a topic of a future CCR article. I note that even with only two positions one can get a reasonable idea of the tactical strength of these programs--the correlation with playing strength is surprisingly high.

How Does It Do That?

by Paul DeStefano

How does the Mephisto Bavaria work? The Bavaria, for those of you who have not heard, is a board that has the ability not only to tell when a piece is placed, but *WHICH* piece is put on the board. It can actually tell a white pawn from a black pawn. It can tell a pawn from a rook. *How?*

Any theory we can think of does not work. For one, the pieces themselves exert no discernable magnetic field, unlike other autosensory pieces which exert quite a strong field. If a piece of cardboard or metal is interposed between board and piece, there is no error in reading, so it is not strength of the field. If a piece is jiggled or slid onto a square, there is no error, so it is not a pattern of rings or any pattern we can tell. A piece does not have to be centered. Rotating the piece causes no problem. Placing two pieces on the same square results in it reading whatever piece is further on the square, no error.

Now the really odd part - a normal board will not read a Bavaria piece, and a Bavaria board will not read a normal piece. Bavaria pieces all feel the same - there is an indentation in the bottom of each piece which you can feel through the felt bottom, unfortunately the indentations are all the same.

I've taken my share of college physics courses, but this board uses some technology that none of us here can fathom. We've even considered audio signals, laser scanning, radio transmissions and rates of radioactive decay - and those are our more reasonable ideas.

So if anyone has any clue whatsoever on what can be used to differentiate twelve different types of piece (fourteen - two 'joker' pieces are included for multiple promotions) through an eighth of an inch of wood, please write me at: 21 Walt Whitman Rd., Huntington Sta. NY 11746. If you enclose a SASE, I will write back on why your theory may or cannot work. Somebody out there must be able to figure this out. Mephisto isn't talking.

Some Choices Are Hard...

Mephisto 68030 36MHz, Elite Avant Garde Version 10, Elite Avant Garde Version 9, Bavaria Munich 32 bit, Elite Avant Garde Version 8, Portorose Munich 32 bit, Portorose Exclusive 32 bit, Elite Avant Garde Version 7, Bavaria Munich 16 bit, Elite Avant Garde Version 6, Portorose Munich 16 bit, Portorose Exclusive 16 bit, Mach IV, Portorose Modular 16 bit, Elite Avant Garde Version 5, Munich Polgar 10MHz, Munich Polgar, Elite Avant Garde Version 4, Modular Polgar 10MHz, Elite Avant Garde Version 3, Exclusive Polgar, Elite Avant Garde Version 2, Modular Polgar, Renaissance, Super Expert C, Leonardo, Galileo, Phantom, Super Forte C, Corona, Dominator, Mach III Master, Designer Mach III Master, Simultano, 6097 Los Angeles (Mach II), Prisma, Commander, Conquistador, Astral, Blitz, Galaxy, Designer 2100 Display, Chesster, Designer 2100, Supremo, Team Mate, Designer 2000 Display, Super VIP, Primo, Quattro, Designer 2000, Mentor 16, Marco Polo, Advanced Star Chess, Chess Coach 1500, Excellence, Genesis, Electronic Chess Partner, Gambit, Cavalier, Chess Pal, M-Chess, Rexchess 2.3 Software, Chessmaster 2100, Chess Card, Micro Chess, Mini Chess, Pocket Chess and more!!

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