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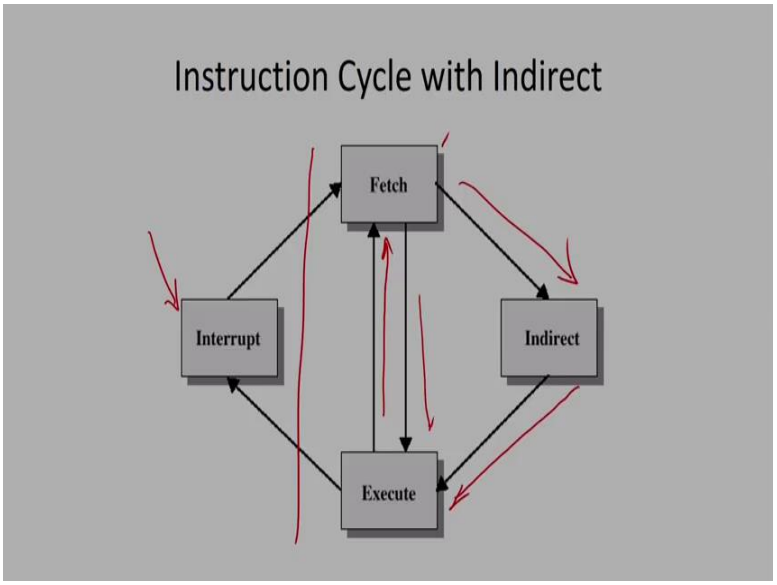

So one simple example I can say that now in general I can say that we are fetching the instruction then we are executing it after completion of the executing we are going to fetch the next instruction. So this is the way we are going to set up fetch and execute, but after fetching some instruction if we know that that instruction needs some data then we have to fetch this particular data from the memory. So for that we are having this particular indirect cycle we are going to fetch the data from the memory and that data will be supplied to the execution unit and it is going to execute it completely.

Here we have shown another one which is written as our interrupt this thing basically related to handling input output devices when we are going to discuss about the I/O module at the time we are going to discuss about this particular interrupt. But currently you consider it is fetch and execute, but to fetch to execute some instruction if we need some data then we will go to the indirect cycle to fetch those particular data. So we have seen now the model of computer and how we are going to execute the program and nowadays you are all of you are using computers to do several different work mainly most of you are doing the net browsing you are sending mail you are writing computer program. Now in this particular course we are going to see how our program is exactly going to executed in the processor and to do that how we are going to design this particular processor, now since we are using computers nowadays, but it is better to know how we are coming to this particular level we are using very advanced computer nowadays and we are solving many more complicated problem with the help of

computer, but in one day we have not achieved it. Just now we are going to give some idea about the history of computers.

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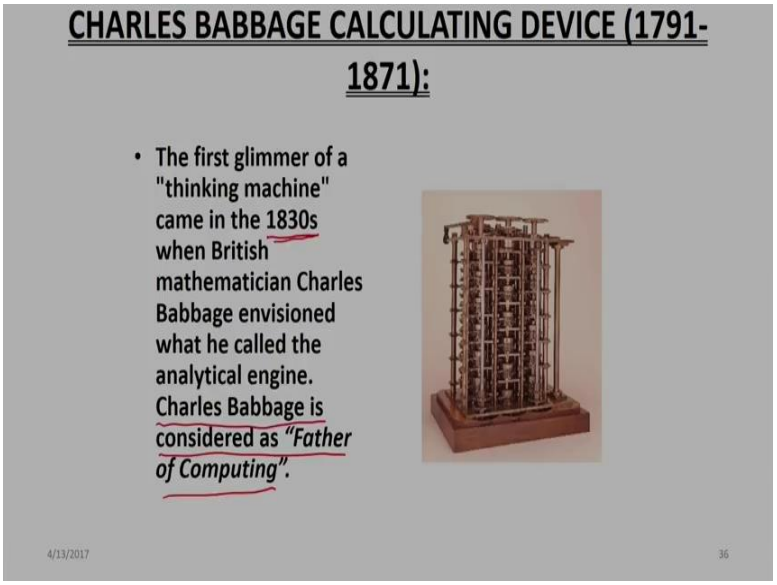

Ok. So if you look it in most of the cases we know that Charles Babbage is considered as a father of computing in most of the book you are going to have these things. So Charles Babbage has defined a calculating devices in 1830, he is a British mathematicians we are doing calculating we know we are doing many more job with pen and paper you say that why you cannot do it automatically. So for that he is coming up with a calculating device and this is called as your analytical engine and the era of this particular automatic computing started somewhere in 1830.

So this is the start and nowadays also we say that Charles Babbage is considered as a father of computing then when we are having this calculating device.

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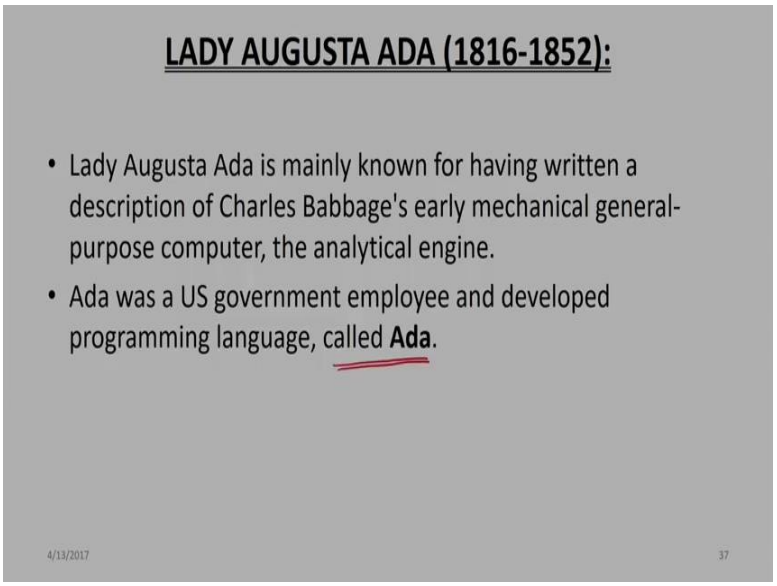

Then we are having the concept of our programming how to program these things how to control this particular calculating devices. For that that Lady Augusta Ada has come up with this particular programming concept. So we are having an initial programming language called Ada that is also somewhere in between 1816 to 1852. So she developed a computer programming language called Ada and we have started with Ada, but nowadays Ada we are not used it. So, she developed a programming language called Ada.

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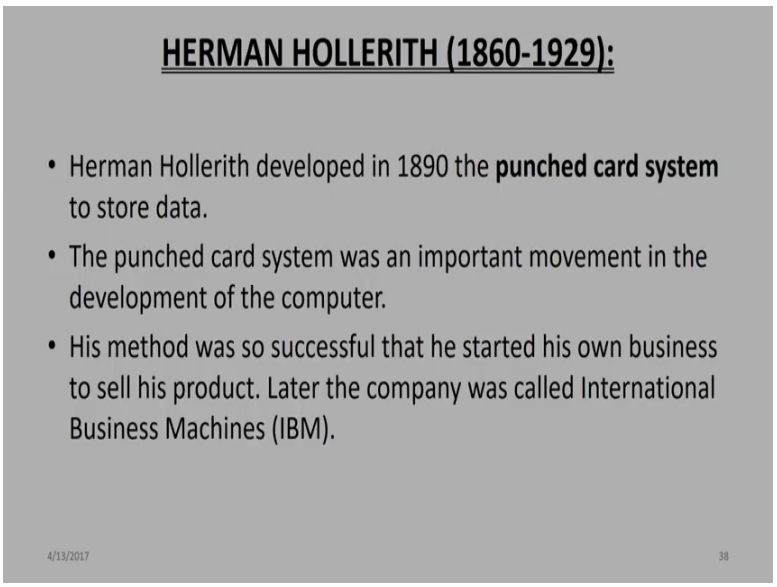

So we are having the issues how to give input to the computer how to put all the information in a computer so that computer can operative. For that we need some mechanism. So Herman Hollerith developed this particular punched card system to store our data. So what it basically does depending on my information we put those things in a paper through holes. So we punch the card and once we punched the entire information in the card then the state of the card will be given to the computer and the computer reads from that particular card.

So this is the punched card system and finally IBM has developed a particular punch card system and I think till 1980's punched card system was used after that only we are going to have that other devices

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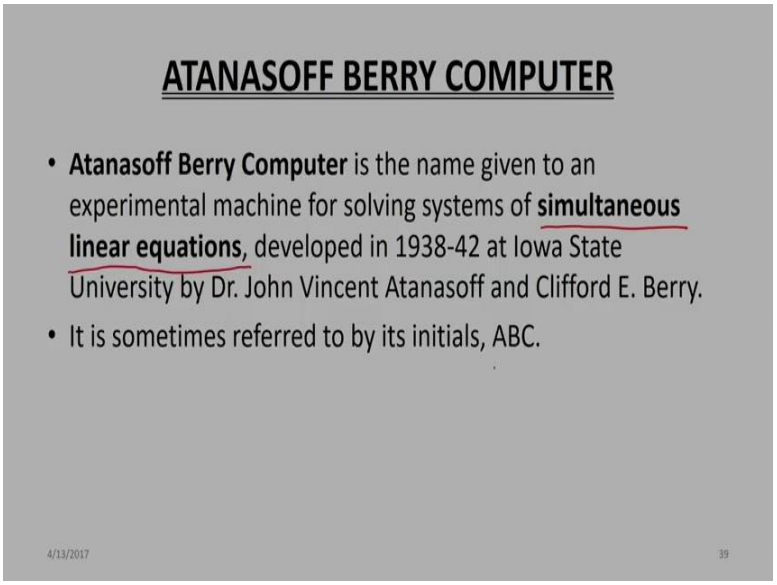

Another machine has been developed by Atanasoff Berry computer known as Atanasoff berry computer is the name given to the experimental machine for solving simultaneous linear equations. So to solve simultaneous linear equation Dr. John Vincent Atanasoff and Clifford E. Berry developed a particular machine. So this is also known as the initials of this particular name ABC. So this is another computing machine that we have in our history which is known as your ABC Atanasoff berry computer and it can solve simultaneous linear equation.

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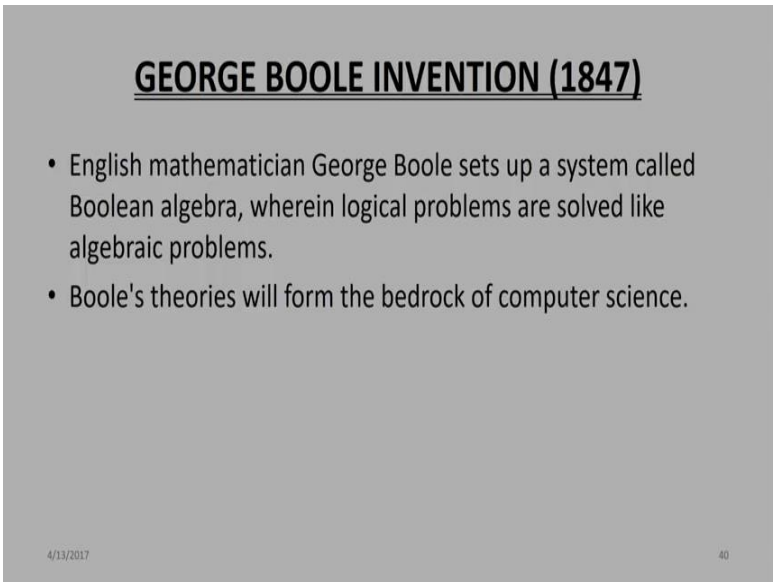

Then we are coming to the George Boole invention. So this English gentlemen are mathematicians come up with the Boolean algebra and that Boole's theory is basically used to solve our algebraic problem. So this is the interfacing between our logic and computing.

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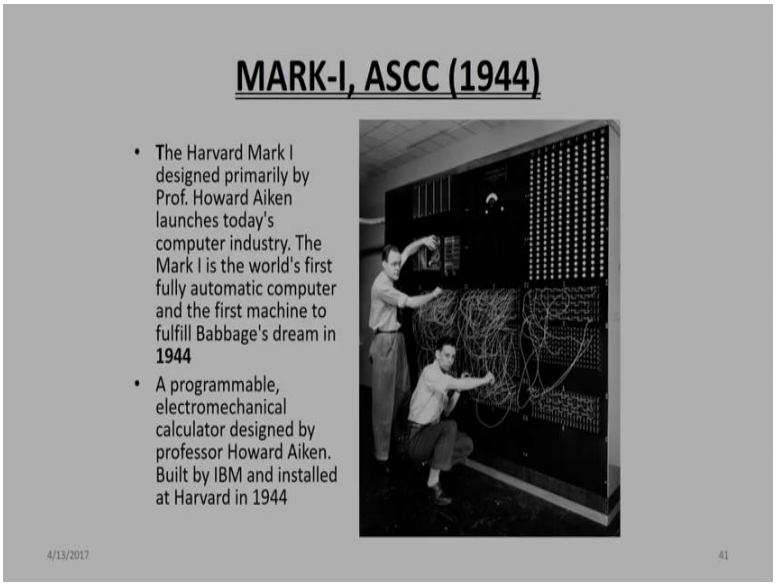

Then finally, the first computers comes in 1944 which is your Mark I. It was developed in 1944 the Harvard Mark I designed primarily by professor Harvard Aiken this is launched today. So this is the view of the computer it is a very big machine so it is a

programmable electromechanical calculator designed by Professor Harvard Aiken built by IBM and installed in Harvard university in 1944 just I am just distrbuting just giving the diagram. So this is the first computing machine full fledged computing machine that we have been in 1944, but again it is some sort of analytical engine.

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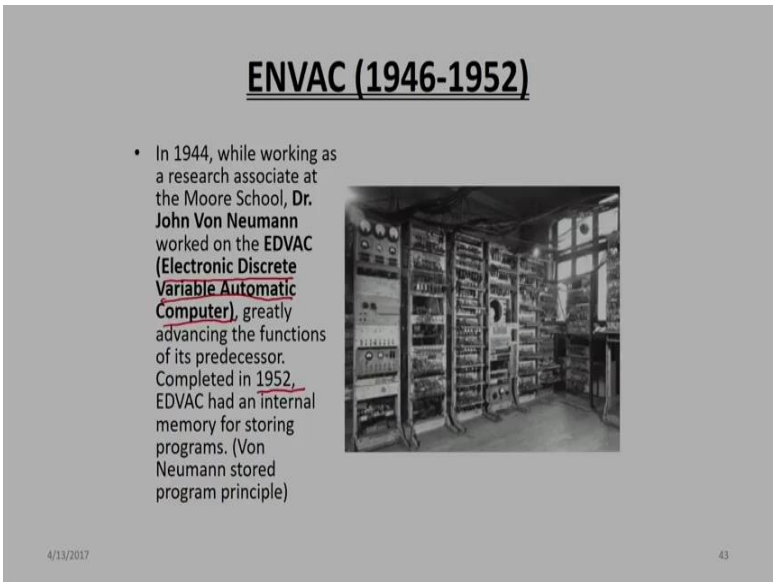

Then next come the ENIAC electronic numerical integrator and computer this is the ENIAC. So this is the first personal electronic digital computer developed for the US army by J. Presper Eckert and John Mauchaly at university of Pennsylvania in 1942 43.

So this is the machine that ENIAC that we have. Next we are having ENVAC. ENVAC is electronic discrete variable automatic computing and this is the computer first computer where we are having the principal of von Neumann stored program principal. So it was completed somewhere in 1952. So ENVAC is the first computer which is resembled with our present computer which works on von Neumann stored program principle.

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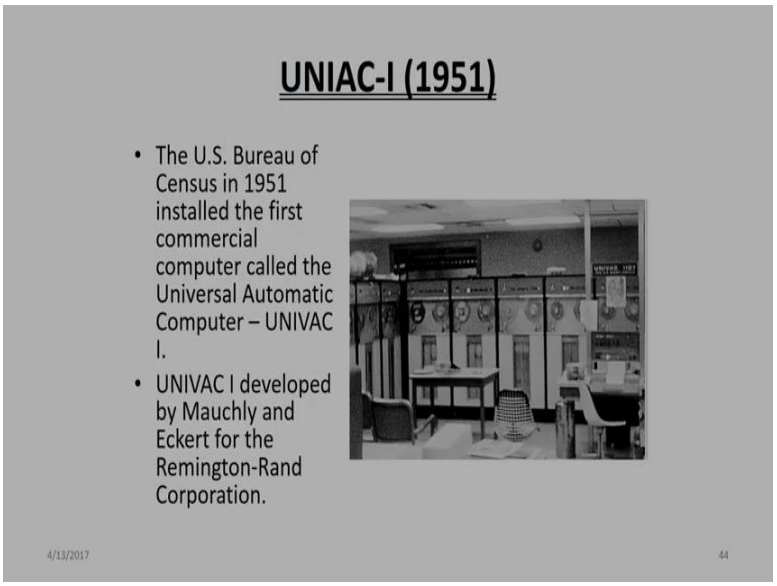

Then next one is UNIVAC 1, so UNIVAC 1 developed by Mauchly and Eckert for the Remington-Rand corporation. Again it was a project of US government for the bureau of census they want to make the census in 1951 and they gave this particular project and finally, that UNIVAC 1 is developed.

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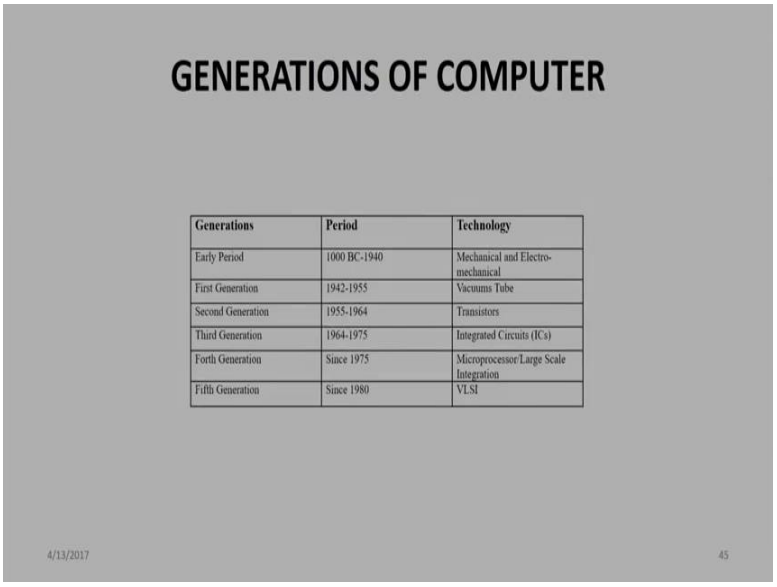

Now, if I look into it then you can categorize the computer into different categories so till now have seen the early histories only now we will see how you are coming to the present level. So in early period till 1940 the technology used is your electrical and

mechanical and electromechanical. So we are having mechanical component those component will be controlled by electromechanical devices. So past generation basically started somewhere in 40s to 50s 1940s to 1955 and in the particular time the technology used is your vacuum tube we use the vacuum tube. So for that whatever diagram we have seen over here these are very big machines because vacuum tubes takes spaces, but main revolution comes when the transistor is developed and all of you know about the transistor and you might have studied transistor also, so main revelation comes in the transistor so this is we are going to talk about the second generation. So vacuum tubes are replaced by the transistor over here so sizes reduces drastically. Then third generation basically started a hummer in 1960s and here we are going to use that integrated circuit. So we said these are the third generation basically in Integrated circuit what will happen we are going to put the components in an IC and you might have seen ICs also then we are coming to the era of microprocessor we said these are the fourth generation. So all the required components will be placed inside a chip ICs which is known as your microprocessor and I think you have worked with a microprocessors now all the computers we have that particular processors and after that fifth generation we are talking about VSLI technology very large scale integration.

So in that particular case instead of putting only the microprocessor we are going to integrate many more things in a wafer and this is the technology currently we are working with this particular. Fifth generation computer in technology wise. Now we have started with mechanical and electromechanical system then we are coming to the vacuum tube then when eventually transistors arrives then life became easiers and we are using transistor exen extensively to build our electronic computer.

Now, at that time itself that scientists Moore has predicted something by looking into the trend of usage of transistors which is known as your Moore’s law.

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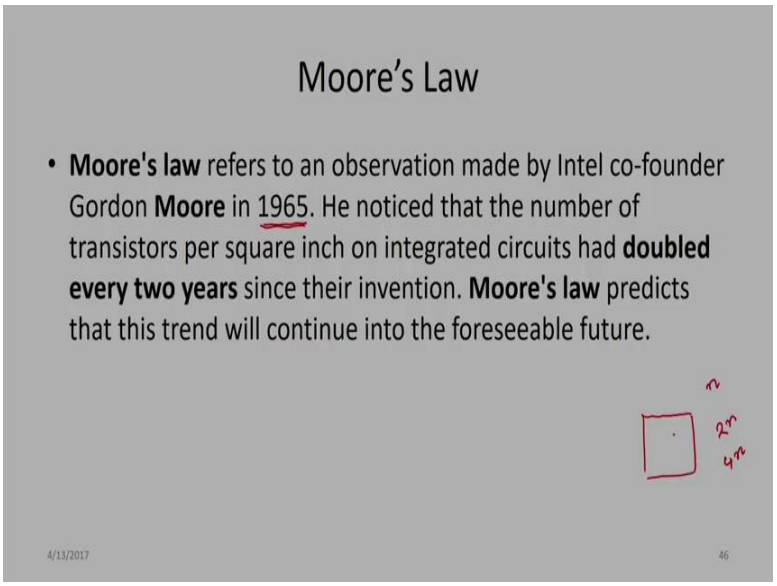

Now, Moore's law reads us like that Moores law refers to an observation made by Intel cofounder Gordon Moore in 1965, so way back in 1965 Moore has observed something. He noticed that the number of transistors per square inch on integrated circuits has doubled every 2 years. So if we take a wafer area of 1 square inch then the transistors that we can incorporate over here today will be doubled in every 2 years. If we can put 'n number of transistor today then after 2 years it becomes 2n, after 4 years it will become 4n. So this is the trend that he have observed and he has predicted and now also that Moores law valids so more and more transistor can be incorporated in same area because technology developed in such a way that now we need very small space to implement a transistor well we say it is a sub micron level in sub micron level you can work. So that is why the packing densities became very high.

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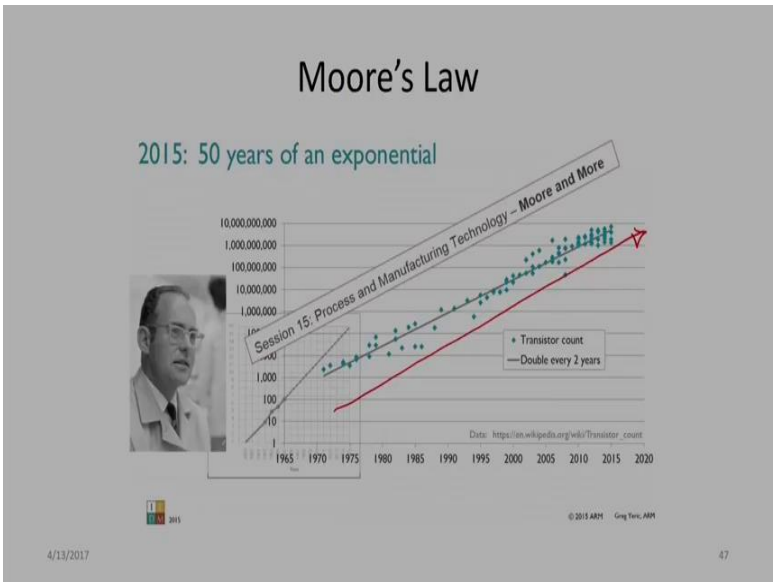

So in that particular case if you look in to the Moores law now it is 50 hertz as predicted in 1965. Now, in 2005 2015 in 50 years still valid. So it is always increasing by following this particular small slope in one particular area it doubles in every 2 years still it is valid. Whatever now we can put in 2015 now in 2020's it will accordingly increase.

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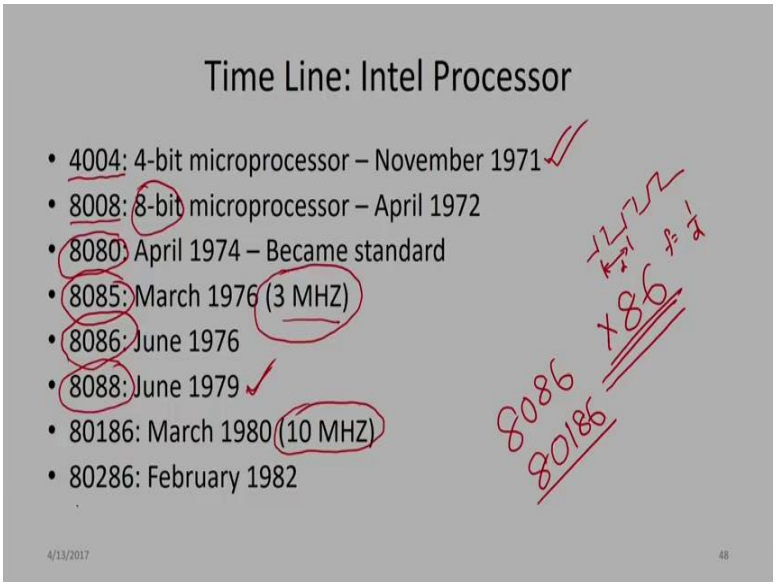

Now, for a particular processor now we are going to see the timeline of the Intel processor because most of you are using Intel processors say earlier days you are using that Intel Pentium processor now a days you are using either i3, i5 or i7.

But in one day we are not getting it what is the timeline just I am going to give you a brief idea. So Intel has coming to this particular micro processor domain in 1971. In 1971 they have released the processor 4004 which is a 4 bit processor. So they have come up with a 4 bit microprocessor in 1971 in the month of November just after 6 month they have come up with the enhanced version of the processor and the next processor is known as your 8008 which is an 8 bit processor. So in the timeline of 6 month they have an enhanced the 4 bit processor to 8 bit processor. Next they have come up with 8080 in April 74 after 2 years and now which became a standard for an Intel group and many people are using these things.

So they have standardized the processor now in 1976 they come up with microprocessor 8085 which works on 3 Megahertz. Ok so see that in 76 we are working with 3 megahertz clock and 8085 is a full fledged processor which can control some devices and as well as do some processing job.

So it is a fully fledged processor that we have and in many places we are using the 8085, but 8085 is not a fully fledged processor to make a computer. Then again in the same year they have slightly modified it and come up with your 8086 and which is a processor which is used to build computers, along with that they are coming up with another processor called 8088.

So these are of processors 8086 and 8088 which are used to build computers in that either this maybe in eighties. So this is the line in 71 they have started their micro processor business and in around 10 years 79 they have come up with a processor which can be used to build a computer that whatever computer you have, now already I think we have mentioned somewhere about that x86 family. So this is the family of Intel x86 family so first processor they are having 8086 and simul similarly they have having another series 8088, but eventually intel has withdrawn this particular 8086 they are not going in that particular time then, but they are continuing their 8086 and coming up with this x86 family. So in the particular case now in 8086 we are having the basic functionalities and it can be used to build a computer then after one year they have enhance it and put some more provision some more facilities and they have released it as a 80186.

So this is your 86, now you just see that in 76 that processor works at 3 megahertz, but now in after 10 years this processor is working 10 megahertz. So I think you know this particular frequency; that means, this is the clock frequency. So if I talk about this particular clock frequency I can say that it is having some duration whatever duration I am having d then frequency is nothing but one upon d and you know that many Hertz.

Ok so in the fraction of time we can perform one operation here one operation means one step that we can perform. So now due to the improvement of technology now in 10 years they have gone from 3 mega hertz to 10 mega hertz, now in this particular x86 family now they Intel has incorporated more and more features and making it more and more advanced and in 1982 they have released 286 then in 1985 they have released 386 and April 91 Intel has released 486.

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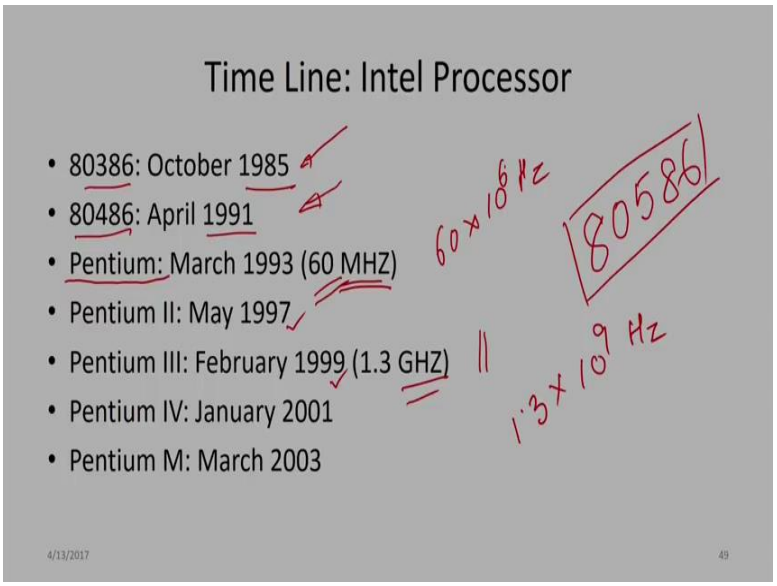

So this is the architecture is same, but they have enhanced it for more and more instruction and so that's why we say that code compatibility at least in a backward direction why you say because whatever software we have written in 386 that same software can be run or executed in 486 because we are enhancing the instruction set. So whatever instruction we have in 386 same instruction we have in 486. So that software will run in 486 also, but if you have developed a software in 486 where you are using those particular new instruction then that program will not run in 386 because some of the instruction is not available in 386. After that computer Intel is developing their

processor and making more and more advanced and they are about to release 80586, but some issues arises over here and due to that they have changed the nomenclature now from instead of numbers they are coming to name. So instead of releasing 586 Intel has released that Pentium series, so this is the same family.

So in 1993 they have released this particular Pentium now this Pentium works on 60 megahertz; that means, they have increased the frequency of the clock event now after that a Pentium 2 is coming into 1997 then Pentium 3 is coming into 1999 and at that particular point users see that that operating frequency is now going from megahertz to gigahertz trends. So 1.3 gigahertz means you know 1.3×10^9 hertz and when you talk about a megahertz it is 60 into 10^6 hertz and 1 hertz is basically related to 1 second. So in that way you can see that how fast we can carry out one particular step then Pentium 4 is coming into 2001 and Pentium M is coming into 2003, after that they are going to the multiple business.

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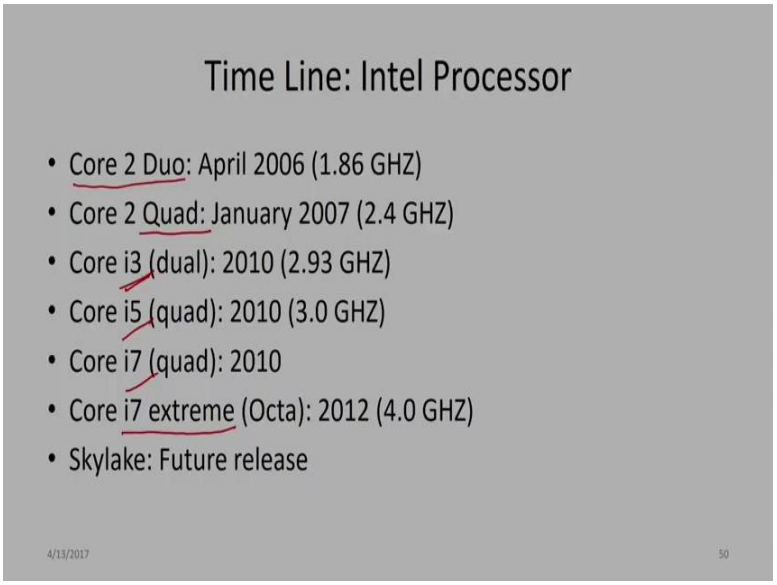

So in till 2003 or till the Pentium M we have only one processor and all the job will be carried out by this particular processor then they have come up with the multi processor. So inside a particular microprocessor chip we may have 2 processors. So Core 2 duo, so in that particular case we are having two processor they are integrating together so; that means, we can perform some parallel task one processor will do one work and second code will do another work. Similarly they are coming up with quad core in quad core we

are having four core together and four core is going to operate simultaneously and they work in parallel so it can be run in a faster way. After that now they are coming with this particular i series in 2010 itself they Intel come up with 3 system core i3, core i5 and core i7 and in after that in 2012 they release core i7 extreme which is Octa.

So i3 is a dual core, i5 is a quad core, i7 is also a quad core but i7 extreme is an octa core. In case of Octa core we are having 8 processing core inside the chip and it works on 4 gigahertz now it has gone to these things and now Intel is working in the same timeline and they are talking about the new release is skylake which will be release in future. So this is the timeline users see that microprocessor era started in somewhere in 71 and in 2011 we are going to core i7 with 4 gigahertz clock cycle.

So due to that now we can now perform we can do many more work with the help of computer because now computer becomes more powerful.

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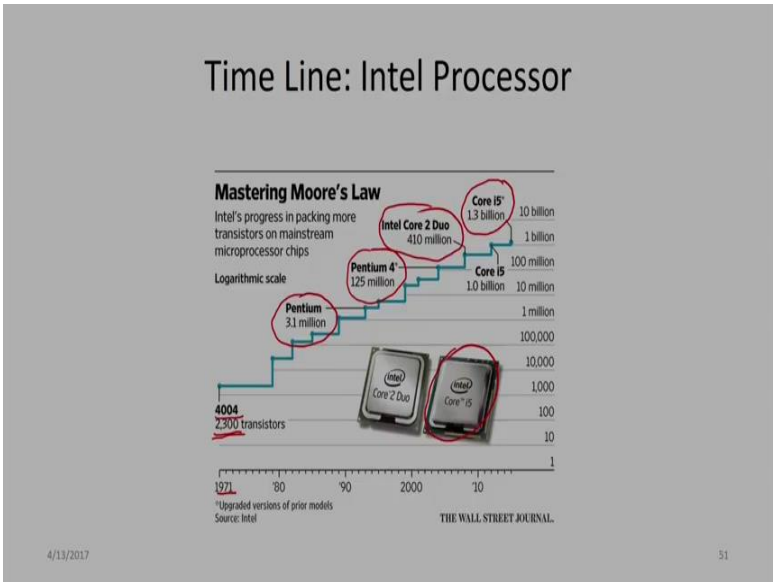

So this is the Intel time line they have started in 1971 with the release of 4004 and that processor microprocessor had 2300 transistor this is basically the showing about the time line with this Moore's law then after that went from 4004 to they come up to 8008 then 8 0x8 x8086, 186, 286 and like that and when they came to the Pentium you can see that the number of transistor come gones up to 3.1 million, when they released this Pentium 4 that transistor count becomes 125 million Intel core 2 duo it became 410 million transistors, now i5 is having 1.3 billion now this is the transistor count that we have in

this particular chip along with that you can look into the area now if you see that density packing density what is the number of transistor in your per square unit of area you will find that still it is going to follow this particular Moore's law. So this is the timeline that we are having. So with this particular timeline now at least we are having some idea how the current transis level computer has been developed from the very basic 4 bit processor.

So this is basically about the introductory part of our computer where we are talking about the knowle module of the computer, how program executes and what is the brief history of development of computer. So with this I think we have achieved our objective of this particular unit we have defined three objective and I think we have achieved those particular 3 objective with the help of this particular unit. Now after going through this particular lecture just look for some test items or some question the first question I am talking about something like that compare the model of computer with human beings.

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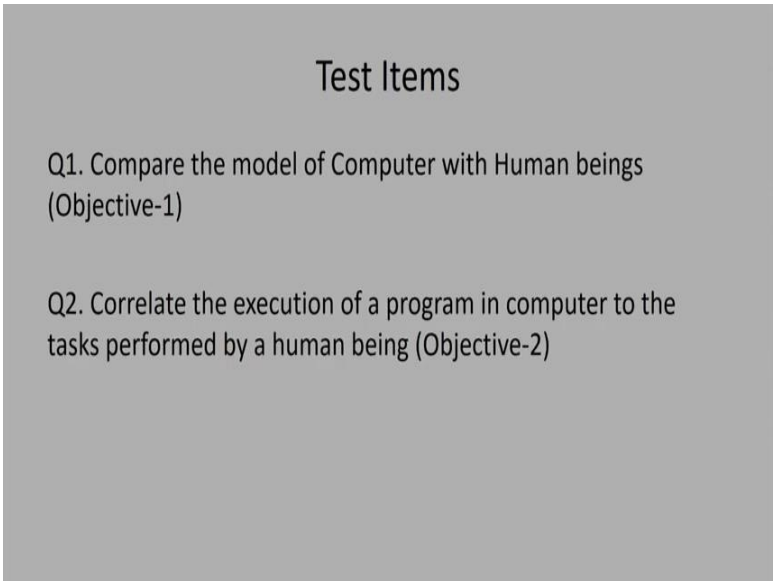

Now, why we have coming to the computers because whatever we are solving whether it can be done automatically or not. So this is the way that we can look into it. So, first objective we are talking about a model of computers and how computer execute a program. So it related to these things that I am giving a test item or one question like that compare the model of computers with human beings. Now you just see I am just anna

giving analogy in computer we are having processing unit, we have memory and we having input devices and we having output devices.

Now, in case of human being also how you work. So we have brain and when we talk about the brain we talk about the memory also we say that someones memory is very high somebodies memory is very low. So basically what will happen we observe the situation we are having some organ like that through eye we can see something, through nose I can smell something, through ear I listen something, by hand I can pick something, through leg I can go from one place to the other place.

So these are the devices or the organs that I am having with these things we are collecting some information and we are storing in our memory and our brain process those particular information from the memory and take appropriate action and to take the appropriate action it activated it activate the appropriate organ. Sometimes it activates my hand to pick up something, sometimes it activates my legs to run away from the place. So, my process takes the information from memory it process it and it activates my some organs so that I can act. So this is the way we can look in the computer also we are having input output devices through input devices we are collecting the information, we are storing it memory, through processor we are processing it and we are giving the output to the output devices. So we can make some analogy of computer model with human. Now question 2 I am talking about correlate the execution of program in computer to the tasks performed by human being now correlate the execution of program in computer to the tasks performed by the human being this is similar to the first one second one we have seen how computer execute a program.

So, this is basically we have def defining objective 2 and first one is we are talking about the objective one; that means, this test item is related to objective 1 we have achieved this particular objective this question is related to the objective 2 we have said how computer works we are going to explain it.

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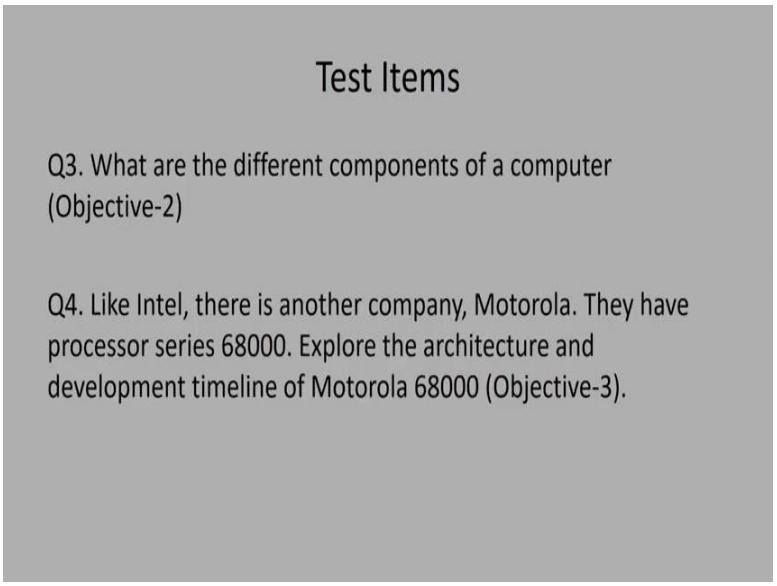

So this is basically you can correlate now execution of the computer program and how execute and how human being carry out their work. Test item 3 we are talking what are the different components of a computer, again in objective 2 we have said that we are going to look into the different components and how they are interconnected like we are talking about the functional view we are talking about the structural view of a computer.

So this is a small test I am giving what are the different components of computers. So this test item is related to your objective 2. Another test item I am giving is like Intel there is another company called Motorola they have processor series called 68000 explore architecture and development timeline of Motorola 68000. So We have just giving some idea again I am talking about that whatever you have discussed about the evolution of computer or brief history of computer we have done in knowledge level only just imparting the knowledge only not going to analyze anything not going to look into the design issues of those particular processor, so in knowledge level we have address it.

So, we have addressed about thus Intel family x86 series and we have seen how that from x86 to 8086 to 80186 and like that we are coming to Pentium then we are coming to core then coming to i3, i5 and i7 . So similarly Motorola is another company who is also working with a processor they are having a series called 68000 this is the basic one now with 68000, now what will happen the are also enhancing the performance of the

processor and in this particular family line timeline they have come up with different processor now you try to explore this particular information and see how they are going to how they have developed this particular processor and enhance the power of the processor, so with that I am going to wind up this lecture of unit 1 of this particular module.

Thank you.