So in the previous video we were looking at white sense non blocking switch and I talked about the states and how to setup the equivalence between the states and in fact I told that you can twist the outputs we can twist the whole switch you can twist the switch actually around so input becomes output and output becomes input or you can actually do up and down so in many direction you can actually move the switch around and they should we can you should be able to transform from other states to the one state then the one to other state then these states will be equivalent states.

And we in fact use that to compute the non equivalent state for signal connection and non equivalent states for the two connections so let us draw those states which I had actually finished up with them in the previous video so this once.
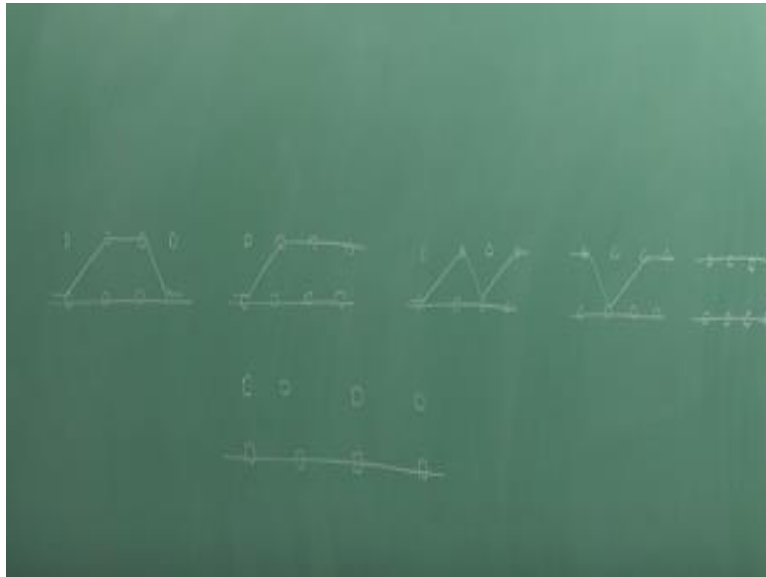
What the states so this was the first state which I had drawn and remember what we are doing is we are trying to prove that this is a white sense non blocking switch it does have a blocking state but by using a suitable algorithm I will be able to operate this switch as if it is strictly non blocking switch okay so in true sense restricts since non blocking switches they will not have any blocking state but white sense non blocking switch will have blocking states but by suitable operational algorithm.

You can avoid those blocking states so the remaining once they were actually like this I will switch back to color diagrams when I will now do the third connection so these are essentially now the states with to which we actually have arrived in the previous video now I have to setup the third connection so I will take one by one each one of this second stage or two connection states and then see if I setup the third connection.

What I will actually can convert them into so I have to essentially do again the equivalent transformation so we will do that so we will take up the first one so I will take up this one and then see what can happen so we will do it on the other side of the board

So we will have this configuration so now let us draw the first diagram in with the for the two connection so this one will look something like this so the second connection which I had is this one which correspond so this particular connection now let me see in how many possible ways I can setup the third connection so third connection obviously has to from here to here okay, so the weight can go is I will take all possible combinations and first one is as usual I will always try to move upward first and then.

Second step to the downward so if actually go upward it has to go downward there is no other it has to go in this fashion that is one possible state so now let us look at the other possibilities I have to also check the equivalence actually second possibility this can actually go to downward so there is no possibility it has to go up and then straight and out now you can actually see if I twist this switch around they both are actually same so third configuration if I do these two are equivalent there is only third possibility.
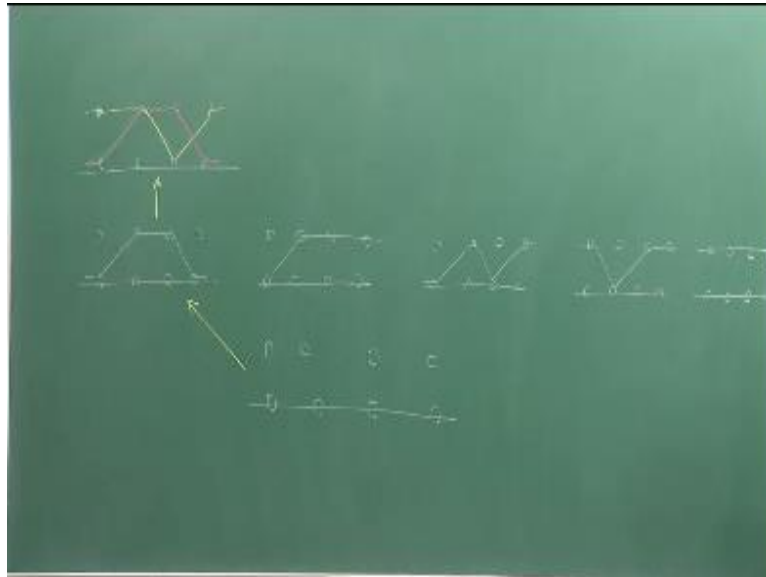
Which can exist there is no other way and this actually you will arrive if you are in this switches state if the movement you setup of the connection you only come to this possibility.
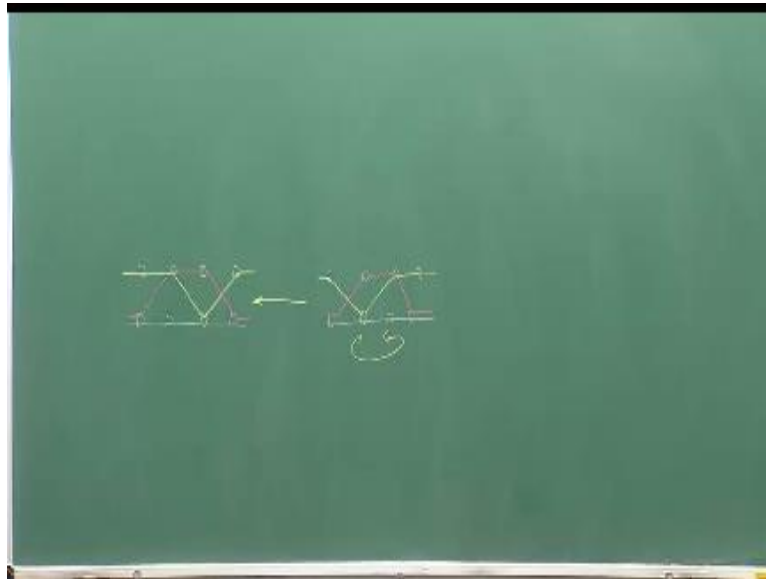
Okay there is no other possibility.

Which will exist okay so this is the third one so we can actually draw this state here okay? So you can actually go from here to here and from here to here okay that is what when I am doing it I setup third connection whatever were I will always come to this particular state okay there is only one state and their two possibilities but both of them are actually technically same so now let me see if what will happen if I take this is state so I can actually reach from here to here.
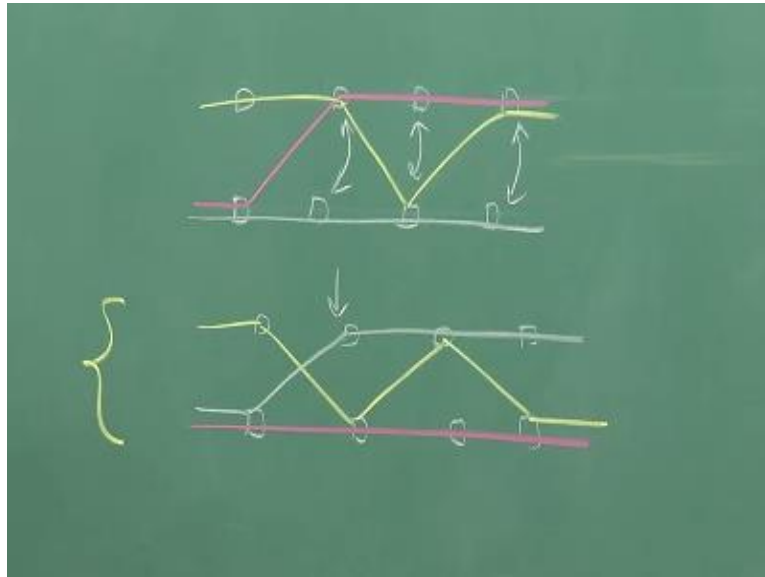
So we have this connection already been done, so now I can actually set up take this input I can connect to this one or I can connect to this one, so let us see what will happen if I do this, okay. So I can go straight first I can take two bottom only with the connection can be made is in this fashion, okay. Now the way the equivalence has to be set up that I would be like both of these to be in the bottom side as far as possible, okay.

And then see what is going to happen, so let us do the transformation, so I will always try that the two inputs or two outputs here occupied to those switches are in the bottom, so basically trying to find out the equivalence with this, so everywhere else there is only bottom we have only two only one of the inputs where the two or both the inputs are occupied than the outputs are from the two separate switches.

In this case the outputs are from obvious both separate inputs stay switches and both output stay switches, so this actually means I have to do the transformation in this fashion and then I need a straight line so that this straight line actually comes in, so I will take this pink one and make it into a straight line which actually implies I have to do this swap I have to do this swap and let us see what will con turn out, okay.

So we will have from here I can then draw the pink straight, okay. So white once so what happen to the white path, so white path will become goes from up and straight, okay. And of course now what happens to the yellow one the yellow one is going down going up, okay and then going down and coming here, so this is a standard configuration which we have, so which only one of the states.

So this get transform to this one, okay. Now second possibility which can exist, is this so I had set up the earlier the yellow line while going towards the top and then coming to bottom and connecting this time I will go to the bottom why end up in the same thing, so these are the only two possibilities which exist there is no other option which is available. They both are technically same, okay.

Except this pink and white gets changed but their technically same so there is only possible state in which the switch actually can go, so let me draw that also, okay. So you will come from here to here so next we have to look into this particular configuration and see what all possibilities will exist.

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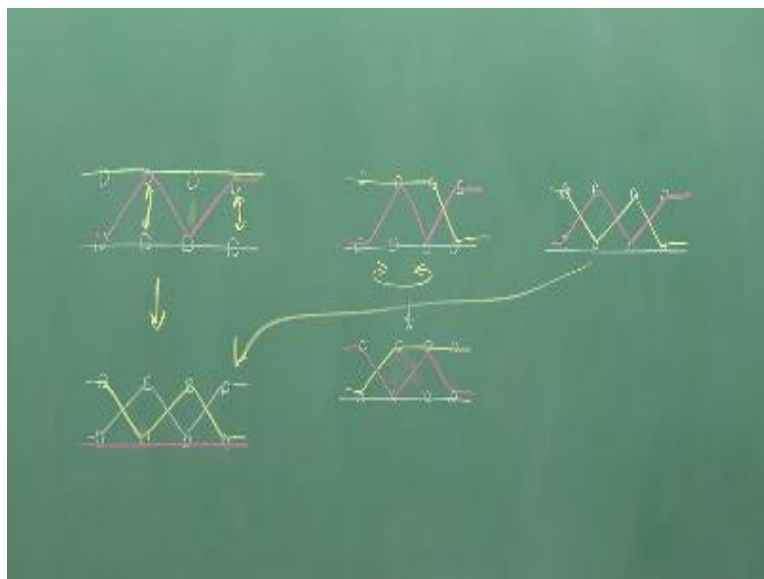
So I will again try to go straight first I cannot go to the bottom I go straight first I can still go straight first that is one possibility but to be on the standard side when I am actually making this three connection thing I am always trying to put two connections coming from the bottom switch on both sides input and output so this one will be now here so I have to do now swap once I do this swap I still need a straight line all the way in the bottom.

So a straight line can only come if I take if I do not do the swap but I do this particular swap these two things has to be swapped and then I will get a straight line in the bottom and both two inputs and outputs on the bottom side let us see what will happen. So important thing is that you have to have a geometrical consistency so once you do this I can actually draw the pink going a straight all the way, what happens to the white?

So white it starts from here goes up it then goes down then it goes up and on this side, what happens to the yellow one? So yellow one goes down yellow one goes up and yellow one goes down and connection is made so this is the configuration which will come, this configuration in no way can be transformed into already done configurations with three inputs, okay so there is no way it can be done these are all different once so I can draw this third one also now let us look at the other option so I should exhausted all the possibilities so I have started from the top I will still go this way but I can go till top and then come back down so that is the first so that I am exhausting this is going a straight third time putting it down.

So I get this configuration this, this configuration is I just simply swap it like this will turn out to be nothing but this one the straight line you will have this now this one is exactly what is being drawn here this one so in fact you can actually move from here to here n adhere to here that is what it means okay so I have not distal exhausted let me see what more can be done if there other possibilities so we have this so now when I want to draw it I cannot go from here to bottom because this line is already occupied so this has to be this is already exhausted two possibilities I have to now start here to the bottom.

If I go to the bottom I go to up I go to bottom oh I need up in the same configuration which is here, so I have exhausted here all possible configurations when the third connection is set up and this, what will be the scenario. Okay so let us move further and talk about the forth one so the forth configuration is.
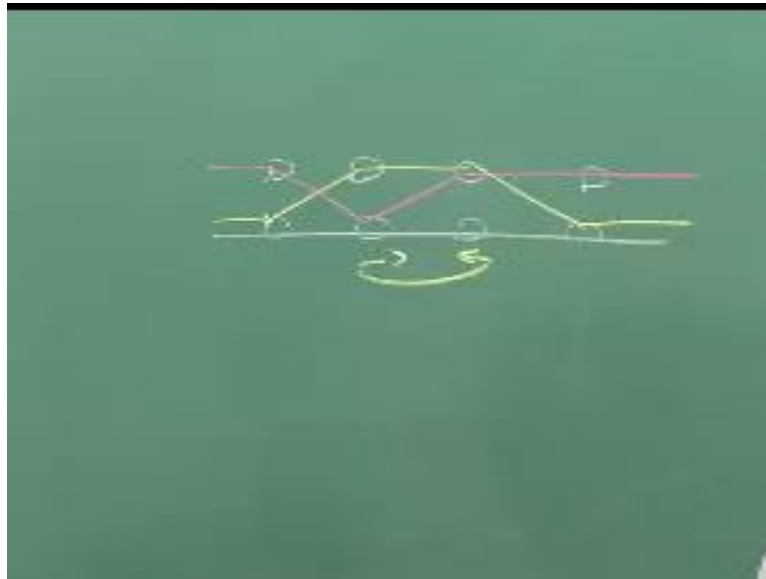
Is this so I will now put all possible configurations which are possible I will start from bottom actually I will try to set up the connection so once I set up with the bottom one so there is no possibilities of the state goes up it should go a state as for as possible a state can hold terms to bottom oh I think I have already got this particular configuration this is what is going to be there. In this case this is the configuration which I am I have actually drawn.

So from here actually I come to this configuration also so I should draw a path here so let us look at all other possibilities in fact this you have to swap input output then it will resulting same so let us draw the other one.
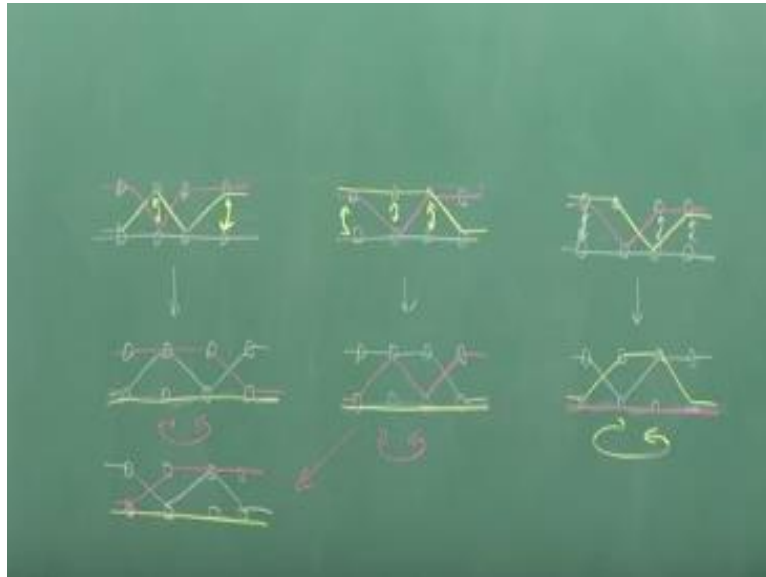
So I actually started from bottom I went to the top and first of all I went straight and then down okay because there was no other possibilities but I could have come to the bottom also let me try this out if I come this way this is a configuration which I will get from this switch so essentially to compare I need to put this down actually so I will do this swap but I need a straight line so yellow I will be actually taking up a straight line.

So these tow need to be swapped so once doing it this is the straight line so I will just do the swap actions so it means this has to be yellow one so I put the yellow one after this swapping so what happens to the white one so white one go comes from the bottom it will go to the top it comes to the bottom then it goes to the top and out and what happens to the pink one so pink one goes a straight comes down and this.

I think if you just turn it around so this will end up in this configuration and this is same as this one so from here also can reach there, so you go, come here and come here, so I have exhausted all the possibilities, actually I was trying to connect from the bottom first, so bottom I went straight, the up the straight and then down, went up came down, two things have been done but, I

have not decided to take up the connection from the top here, so let's do that and see what is going to happen. So I have to exhaust all possibilities.

So this time I'm starting up the connection from the top, so if I start from the top I have to go straight, and first attempt is trying to go straight coming down, no I think this one is already there, you cannot come here, currently because you have to at least, take this node 1 down, so I will do the swap, this one as the swap, so this one here, I have to make the yellow as the straight line, so I have to do this.

I will make the yellow as the straight line, so once I do it what happen to the white, white actually is coming from the top now, going to the top, remaining going to the top and then coming down, and what happens to the pink one, pink one starts from the bottom and goes up, then goes down, and then goes up and again, and if I turn it around, you end up in this configuration, you end up in the same configuration which is already been mapped.

So from top also I have seen, I have exhausted all the possibility, It has went straight and went down, but I dint go down from here also, let's see what is going to happen in that case, so I went straight, earlier I went straight, I have already exhausted that particular mechanism, so I will go down now, so I have to go up and I will come to this situation. Now, this is equivalent to what, so I have to essentially now convert, so I want the two outputs wherever assumed occupied has to be at the bottom, two inputs has to be at the bottom.

So I will do the swapping, and I need a straight line, so I can either keep pink or I can keep yellow, both are fine. So in this case, I will keep pink one, so in that case I will do this swap. I will do this swap. So drawing it let's see what I will get and I should draw a pink here, because that's what I want, so I will draw a pink as a straight thing, so now you understand that actually I'm twisting the switches inputs and outputs everywhere, because I'm not bothered, because I'm just doing it without especially stating.

So I have mentioned in the previous row, that this actually can be done, so let's do it with the, what happens to the white one, so white has gone up, this white will go down, there was no swap here, so now white will go up, it will remain up and out, what happens to the yellow one, yellow one starts from the bottom, goes to the up, remains on the up and then goes to the down, oh this turns out be the, this configuration if I do the swap this turning.

So input is making output, output is getting input, and you will end up in the same configuration which is here in the first one, now I exhausted all possibilities for the tree connections at top, for this. So from this state you can only reach this possible state, from this you can reach this, from this you can only reach here, from this you can only reach here.

So now we are left with this one, so let see what is going to come out. As usual I will start from the bottom, I will go up, down, up and as usual, I want to compare, so I want this to be on the bottom side, let's do that, then I get a straight line which actually means I have to do this swap also, once I do this, so yellow is the straight line, so I'm keeping it here, so let's see what happen to the white, this goes from the bottom, from the top and out, what happens to the pink one, goes to the bottom, goes to the top, goes to the bottom, this is same as this one.

So from here you can actually reach here, so there was only one possibility if I set up the connection, from the upper one, then what is going to happen, so if I make from the upper one, there is no way I have to go in this fashion, I can twist it around, I will end up in the same configuration, this. So only state from here you can go is this one and when you set up the fourth connection, then what is going to happen?

When you want to set up the fourth connection, then what is going to happen in this case, from here you will be able to come, I am drawing it here, on the bottom side I can actually write it down we have a straight line, pink one going this way, the yellow one and of course we have a blue one this what is going to come okay, and of course if you start from here this one .So the blue one will go straight come down go up and this and clearly these two are not equivalent to this .you actually can see so these two are not equivalent, no way you convert from here to here whatever way you do because these two inputs are terminating here.

While these two inputs are terminating here, while these two inputs are been working out these two inputs are also working out so these two are in different states, so they are non equivalent once. So from here there is only one possibility which can happen, which is this and there is a last connection so this is a different one okay. So none of these can be converted to that one, whatever way you do okay, of course though its look like this actually can be done but you probably you cannot do it.

Whatever these two are different once now once I have this whole state diagram now I have to talk about how come it's a white sense non-blocking switch now you to identify which particular state is a blocking state. In this case if you want to set up connection it will go through if any input and output there is first state second one so once you set up any connection from any input to output you can actually do, and you will end up in any one of these state actually.

But if you are in this state's you can set up a time third connection. So from this input I can connect to this from this input, because these are not available. From this input I can connect as here as well is here both are possible okay? And both if I do it I will end up in the same state here I can connect from here to here as well as from here to here, I will end up in one of these two state okay.

I can similarly set up a connection from here to here or here to here both actually are possible if you want to go from here to here you just go straight and this way, so you end up in this state. If you connect from here to here you will end up in this state okay. But here is the problem if I want to connect from here to here it is actually not possible so let's try to see if he can actually do it or not .
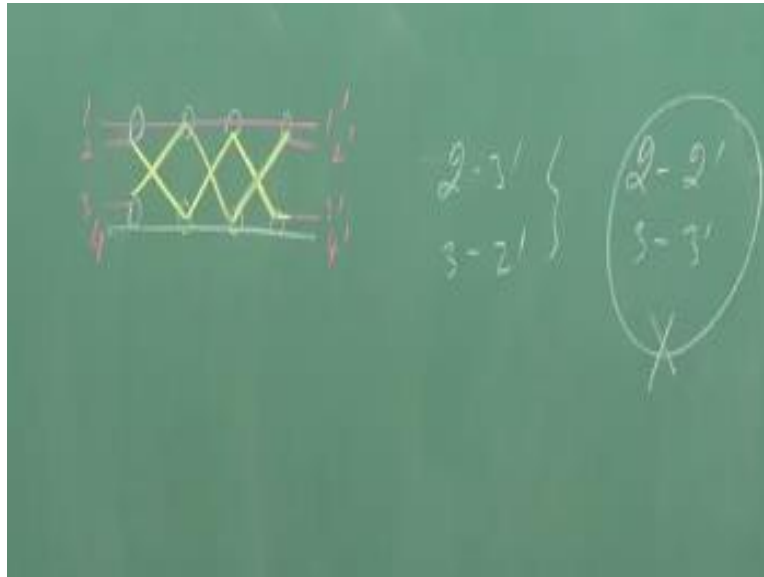
So if I have connection is this other connection is this so this 1 this is 4 ,so there is 2 there is 3 so 1 prime ,4 prime,3 prime and 2 prime, I cannot . If I want to make the connection only way the connection can be done is 2 can go up and down ,so I can only make a connection which is from $(2-3)$ prime and (3-2) prime while (2-2) prime and (3-3) prime is not possible . This one is the blocking state.

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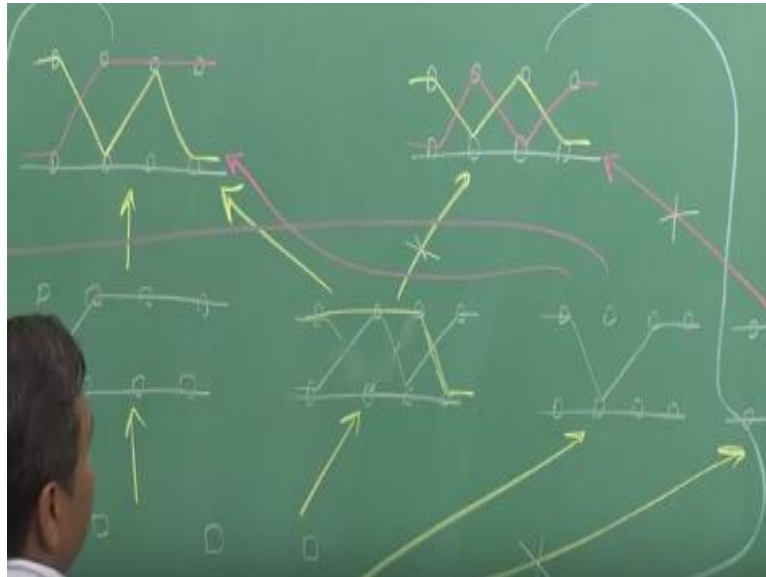


Now whenever I am going to set up a blocking connection so if you want to set for a example second connection, I had a many option actually if in want to for example set up from this to this it's okay. So from this input I will never end up in this state. But if I start from here I have two options by which this can be this input can be connected to this output, I can either go to this or go to this.

So it is my operational algorithm which will tell that when you want to set up the connection from here to here never go to this state avoid it, so this conjunction is not permitted . So you have to go to this state and from there you will be going to these states and to of course to this one and you can come back in the same fashion. But there is a still a problem it is possible when I setup a second connection goes from here to here and I ended within this state which can go to this state and from there I will be able to and if my correction is release I may end up in this which is again becomes a blocking one.

My switch should never actually enter in to a blocking state so what I should do is I should restrict this particular movement in the back word direction, when a connection is dismantled so I should I need to even avoid this state. So this is also a probity transition. So when the third

connection is done so if the connection is from a ,this one to this one I can actually do it using in this fashion so you end up in this fashion so you end up in this way I should not do that, okay I should instead use this other option ,I should go to bottom and then up and then of course , one was going this way let me just draw it so I will ended up this.

So this kind of configuration not permitted instead what should I do is I should not use this configuration I should instead go straight and bottom and this will become this configuration, so this is the way that the third connection should be set up and i should avoid going into this state ,all kind of connection can be set up so far I am not permitting these 2 transition .

So you will never see blocking if you avoid from here to there, and from here to here. So these two transactions ,so these are avoided your switch will operate as a wide sense non blocking switch and this is how actually we prove that a four stage system with 2 binary blocks in each stage will be a white sense non blocking switch .

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