B4 6H O@ J8

KITE %^%$%/%m%W%m%;%C%5$rMQ$$$?
%O!<%I%&%'%"/%=%U%H%&%'%"!&
%3%G%6%$%s

;a L> !'>eJ?>M;L

3X@RHV9f !'2210940045-2

;XF3650w !';3:j>!9065<x

Ds =P F| !'1998G/27n20F|

N)L?4[Bg3XM}9)3XIt>pJs3X2J

FbMF9<35

%O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s$O!"Bg5,LO$+$DJ#;($J%7%9%F%`$r%O!<%I%&%'%"5Z$S!"%=%U%H%&%'%"$N%H%l!<%I!&*%U$r9MN8$7$F!":GE,@_7W$r9T$&<jK!$N$3$H$G$"$k!#%O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s$O!"=>Mh!"=ON}<T$N4*$H7P83$K$h$C$F2r7h$7$F$-$?LdBj$G$"$k$,!"6aG/$G$O!"%W%m%8%'%/%H!&A!<%`$r7k@.7F!"%7%9%F%`@_7W$r9T$&<jK!$X$HJQ$o$C$F$-$?!#$=$NGX7J$K$O!"%3%s%T%e!<%?$N=hM}G=NO$N8~>e$KH<$C$F!"CAD $dFPGA!"HDL $,EP>l$7!"%O!<%I%&%'%"$H%=%U%H%&%'%"$N%H%l!<%I!&*%U$r9MN8$7$J$,$i!"%7%9%F%`@_7WrG$-$k4D6-$,@0$CF-$?$3H,$"$2il$k!#$^$?!"$3li$NGX7J$+$i!"%O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s$N8&5fBP>]$b%7%9%F%`C1BN$N@_7W$+$i!"%7%9%F%`$N<+F0@8@.XHJQA+7F$$$C$?!#

0J>eNMMJ8&5fGX7J$+$i!"K\8&5fGO!"%7%9%F%`$N<+F0@8@.$N<B8=$K8~$1$F!"$=$NBh0lJb$H$7$F!"KITE %^%$%/%m%W%m%;%C%5$r<B:]$K@_7W$7$F!"KITE %^%$%/%m%W%m%;%C%5!&\!<%I$NFPGA $GF0:n$N3NG'$r9T$&$3$H$rL\I8$H$9$k!#$^$?!"<+F0@8@.%7%9%F%`$K4X$7$F9M;!$9$k!#

%^%$%/%m%W%m%;%C%5$N@_7W$K4X$7FO!"%l%8%9%?$K4X$7FO!"%7%_%e%l!<%?$NB>$K!"FPGA GNF0:n3NG'$r9T$C$?!#L?Na%G%3!<%@$K4X7F$O!"%7%_%e%l!<%?$Khk%F%9%H$NB>$K0lIt!"FPGA >e$G%F%9%H$7$?!#ALU $K4X$7FO!"%7%_%e%l!<%?Kh$k%F%9%H$N$_9T$C$?!#%7!<%1%s%5$K4X7F$O!"KITE %^%$%/%m%W%m%;%C%5$N%a%b%j!<!"IO %]!<%H$K%"%/%;%9$9$kItJ,$N:n@.$r!"8=:_9TCF$$$kH3mG$"$k!#

<+F0@8@.%7%9%F%`$N9M;!$K4X$7$F$O!"%7%9%F%`3+H/$N<j=g$r<BA)9k3H$rL\E*$H7F9T$&$bNG!"CPU $N<+F0@8@.!"%3%s%Q%$%i$N<+F0@8@.$K4X7F=RYk!#

L\<!

1 O8aK

%O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s$O!"Bg5,LO$+$DJ#;($J%7%9%F%`$r%O!<%I%&%'%"5Z$S!"%=%U%H%&%'%"$N%H%l!<%I!&*%U$r9MN8$7$F!":GE,@_7W$r9T$&<jK!$N$3$H$G$"$k!#%O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s$O!"=>Mh!"=ON}<T$N4*$H7P83$K$h$C$F2r7h$7$F$-$?LdBj$G$"$k$,!"6aG/!"$=$NMMAj$,JQ$o$C$F$-$?!#@_7W$9$k%7%9%F%`$NJ#;(2=$H%3%s%T%e!<%?$N=hM}G=NO$N8~>e$Khj!"%W%m%8%'%/%H!&A!<%`$r7k@.$7!"%7%9%F%`@_7W$r9T$&<jK!$,Ds>'$5l?$?$aG"$k!#$^$?!"CAD $dFPGA!"HDL $NEP>l$Khj!"%O!<%I%&%'%"$H%=%U%H%&%'%"$N6(D44X78$rC5$jJ,$i%7%9%F%`@_7W$G$-$k4D6-$,@0$C$F$-$?$3$H$bMW0x$N0l$D$G$"$k!#$3$l$i$NMW0x$+$i%O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s$N8&5fBP>]$O%7%9%F%`C1BN$N@_7W$+$i%7%9%F%`$N<+F0@8@.$X$HJQA+$7$F$$$C$?[9]!#

%7%9%F%`$N<+F0@8@.$O!"%7%9%F%`$N@-G=!"%3%9%H$r7hDj9k3H$+$i;O$^$j!"<!$KCPU $r<+F0@8@.$9$k!#$?$@$7!"CPU $N<+F0@8@.$K4X7F$O!"%(%s%I%f!<%6$N4uK>KhCF>JN,G-$k!#<!$K!"%3%s%Q%$%i$N<+F0@8@.$r9T$&!#:G8e$K!"$"$k8@8l$KhC$F5-=R$5l?FC<lMQES8~$1%7%9%F%`$r%O!<%I%&%'%"$H%=%U%H%&%'%"$K<+F0J,3d$7!"$5iK<+F0@8@.9k!#

%O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s$K$*$1$kL\I8$O!"%7%9%F%`$N@_7W4|4V$NC;=L!"5Z$S%3%9%H$N:o8:$K$"$k!#@_7W4|4V$NC;=L$O!"%^%$%/%m%W%m%;%C%5$r4^$`%O!<%I%&%'%"$d4pK\%=%U%H%&%'%"$r<+F0@8@.9k3HKhCF<B8=9k!#%3%9%H$N:o8:$K4X7F$O!"%O!<%I%&%'%"$N5,LOrG$-$k$@$1>.5/7FJ*M}E*$K%3%9%H$N:o8:$r<B8=$9$k!#$^$?!"@_7W4|4V$NC;=LKhCF$b<B8=$G$-$k!#

3l$^$G%O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s$O!"MM!9$J;kE@$+$i8&5f$5lF$-$?!#!VULCAN!W"!VCOSYMA!WJI$KBeI=$5lk%7%9%F%`%l%Y%k$NJ,3d$KhkJ}K!!#!VPEAS-I!W$KBeI=$5lkCPU $rHDL KhCF<+F0@8@.9kJ}K!!#!Valen-C %3%s%Q%$%i!W$Nh&$J%3%s%Q%$%i$N:GE,2=$KhkJ}K!JI$,$"$k[8]!"[9]!#

0J>eNMMJ8&5fGX7J$+$i!"K\8&5fGO!"%7%9%F%`$N<+F0@8@.$N<B8=$K8~$1$F<B:]$K%^%$%/%m%W%m%;%C%5$r@_7W$7!"KITE %^%$%/%m%W%m%;%C%5!&\!<%I$NFPGA $GF0:n$N3NG'$r9T$&$3$H$rL\I8$H$9$k!#$^$?!"<+F0@8@.%7%9%F%`$K4X$7$F9M;!$9$k!#%^%$%/%m%W%m%;%C%5$N:n@.$K4X7F$O!"KITE %^%$%/%m%W%m%;%C%58_49NbNr:n@.9k[3]!A[6]!#3lKhCF!"%/%m%9%=%U%H%&%'%"[6] $N;HMQ$,2DG=HJ$j!"%G%P%C%/$r?WB.$K9T$($k%a%j%C%H$,$"$k!#

%^%$%/%m%W%m%;%C%5$O!"$=$N5!G=$rALU!"L?Na%G%3!<%@!"%l%8%9%?!"%7!<%1%s%5$KJ,3d$7$F@_7W$9$k!#ALU GO;;=Q1i;;!"O@M}1i;;!"%7%U%H1i;;!"2sE>1i;;$r9T$&!#L?Na%G%3!<%@GO!"L?Na%l%8%9%?$H%U%i%0%l%8%9%?$+iCMr<u<h$j!"8=:_<B9T$9Y-L?Na$N2r@O$r9T$&!#L?Na$N2r@O$K4X$7FO!"L?Na%;%C%H!"%"%I%l%9J}<0!"J,4t>r7o!"3JG<@h%l%8%9%?!"6!5k85%l%8%9%?!"Id9f%S%C%H$N2r@O$r9T$&!#%l%8%9%?$O16bit $N%l%8%9%?$r5 $D!"1bit $N%l%8%9%?$r1 $D!"4 %S%C%H$N%l%8%9%?$r1 DN7W7 DrMQ0U9k!#1bit $N%l%8%9%?$O!"%W%m%0

%i%`!&+%&%s%?$G$"$j!"%$%s%/%j%a%s%H$N5!G=$rIU2C$7$F$$$k!#%7!<%1%s%5$O!"%^%$%/%m%W%m%;%C%5$NCf?4E*$J2sO)$H$7$F!"%W%m%0%i%`$N>uBV$r4IM}9k!#$^$?!"%a%b%j!<$dI/O%]!<%H$X$N%"%/%;%9$r9T$&$bNG$"$k!#

%^%$%/%m%W%m%;%C%5$N@_7W$O VHDL $G9T$&!#VHDL $G5-=R$7$?%W%m%0%i%`$rO@M}9g@.$7!"%M%C%H%j%9%H$N@8@.$r9T$&!#$=$N8e!"PIN $N3d$jIU1r9T$$!#KITE %^%$%/%m%W%m%;%C%5$N FPGA $K%@%&%s%m!<%I$7!"F0:n$N8!>Z$r9T$&!#

K\O@J8GO!"$^$:Bh 2 >O$G<+F0@8@.%7%9%F%`$N0lHILO@$r=R$Y$k!#Bh 3 >O$G$O!"KITE %^%$%/%m%W%m%;%C%5$N%"!<%-%F%/%A%c$K4X7F=RYk!#Bh 4 >OGO!"HDL KhCF!"<B:]$K%^%$%/%m%W%m%;%C%5$r:n@.$9$k2aDx$r=RYk!#Bh 5 >OGO!"%^%$%/%m%W%m%;%C%5$N@-G=I>2A$r9T$&!#$^$?!":#8e!":n@.9kM=Dj$N%=%U%H%&%'%"$K4X9k9M;!$r=R$Y$k!#Bh 6 >O$G$O!"K\O@J8$N7k8@$H:#8e$N2]Bj$rDs<($9$k!#

2 %O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s<jK!

2.1 %7%9%F%`3+H/$NN.$l

%O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s$N8&5fBP>]$O!"Bg5,LO$+$DJ#;($J%7%9%F%`$N:GE,@_7W$r<+F0E*$K9T$&$3$H$G$"$k!#$7$+$7!"8=:_$G$b%7%9%F%`$r<+F0@8@.$O!"<BMQ5l$kCJ3,$K$O;j$C$F$$$J$$!#

0J2<$K%7%9%F%`$N@_7W$r9T$&:]!"N10U9kE@$K4X$7$F=R$Y$k!#

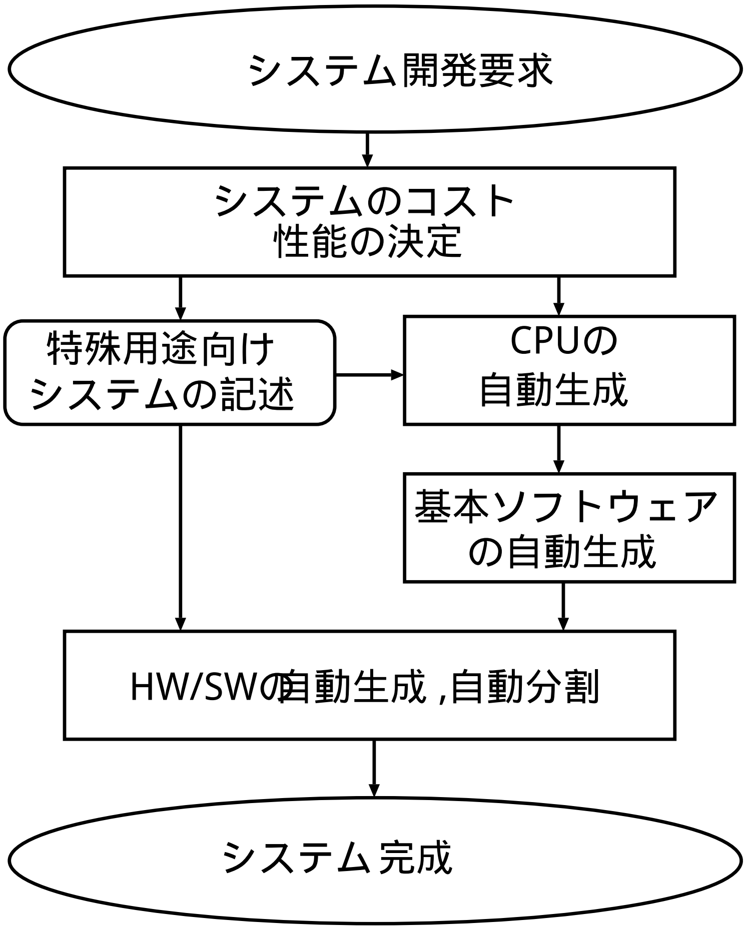
- %7%9%F%`3+H/M=;;
- CPU $N@-G=
- FC<lMQES%O!<%I%&%'%"
- FC<lMQES%=%U%H%&%'%"
- %a%b%j!"F~=PNO%]!<%H

8=:_!"Ds0F5l$F$$$k%7%9%F%`3+H/$NN.$l$r!"?^1$K<($9!#%7%9%F%`@_7W$NMW5a$,=P$?>l9g!"$^$:@-G=$H%3%9%H$rL@3N$K9kI,MW$,$"$k!#%7%9%F%`$N@-G=$O!"CPU $J$I%O!<%I%&%'%"$N@_7W$KBg$-$J1F6A$r5Z$\$9>e$K!"7hDj$K;~4V$,$+$+$k!#$^$?!"%7%9%F%`MW5a$NJQ99JI$bIQHK$K5/$-$k$?$a%7%9%F%`$N@-G=$H%3%9%H$N7hDj$r;Y1g9k%=%U%H%&%'%"$N3+H/$,I,MWG"kH9M$($ilk!#

CPU $N<+F0@8@.$K4X7F$O!"L?Na%;%C%H$d%a%b%j!<4X78!"FC<lMQES8~$1%O!<%I%&%'%"$N%$%s%?!<%U%'!<%9$K4X9k>pJsrbHK9T$&!#L?Na%;%C%H$d%O!<%I%&%'%"$N%$%s%?!<%U%'!<%9$K4X$7FO!"$"$i$+$8$a!";vNc$rMQ0U7F$*$/3H$b9M$(il$k!#CPU $N<+F0@8@.$O!"4{B8$NCPU $r;H$&>l9g$O!">JN,$G$-$k!#

4pK\%=%U%H%&%'%"$N<+F0@8@.$O!"CPU $N>pJs$rbH$K%3%s%Q%$%i$dOS $N<+F0@8@.$r9T$&$bNG$"$k!#

:G8e$K!"$"$k8@8l$G5-=R5l$?%W%m%0%i%`$r%O!<%I%&%'%"$H%=%U%H%&%'%"$K<+F0J,3d!"<+F0@8@.$7$F%7%9%F%`$r40@.5;$k!#



?^1: %7%9%F%`3+H/$NN.$1

2.2 @-G=!"%3%9%H$N7hDj;Y1g

%7%9%F%`3+H/MW5a$,$G$?>l9g!"$^$:!"%7%9%F%`$N@-G=$H%3%9%H$r7hDj$7J1lPJi$J$$.%7%9%F%`$N@-G=!"5Z$S%3%9%H$K4X$7$F$O!"0MMj<T$H@=:n<T$N4V$G$NLJL)$JBG$A9g$o$;$,I,MW$H$J$k.$7$+$7!"<B:]$KMW5aDj5A$,3NDj$9$k$^$G$K$O!"B?Bg$J;~4V$rI,MW$H$9$k.$=$N$?$a%7%9%F%`$N@-G=$H%3%9%H$N7hDj$r;Y1g9k%D!<%k$,I,MW$G$"$k$H9M$(il$k.$3$N%D!<%k$O0MMj<T!"@=:n<T$NN><T$,MxMQG-kbNG$"$k3H$,K>$^$7$$.

3N%D!<%k$N6qBNE*$JL\E*$O!"CPU!"FC<lMQES8~$1%O!<%I%&%'%"!"FC<lMQES8~$1%=%U%H%&%'%"!"%a%b%j!"F~=PNO%]!<%H$K4X$9$k7hDj$r9kbNG"$k.6qBNE*$K$O!"%O!<%I%&%'%"$G<B8=9Y$-5!G=!"$^$?$O<B8=9k3H$,K>$^$7$$5!G=$rL@3N$K$7!"CPU $N%"!<%-%F%/%A%c$dFC<lMQES8~$1%7%9%F%`$N5-=R$K4X$9$k>pJs$r3NDj$5$;$k$b$N$G$"$k.$3$3$G7hDj$5$l$?>pJs$O!"CPU $N<+F0@8@.It$HFC<lMQES8~$1%7%9%F%`$N5-=RItXAwilk.

2.3 CPU $N<+F0@8@.

CPU $N<+F0@8@.$H$O!"L?Na%;%C%H$d%a%b%j!<6u4V!"IO %]!<%H$K4X$9$k>pJs$rbH$KCPU $rVHDL $dVerilog-HDL JI$N%O!<%I%&%'%"5-=R8@8lKhCF CPU $r@8@.$9k3HG$"$k!#

CPU @8@.$N:]!"N10U$9k3HO$r0J2<$K<($9!#

- L?Na%;%C%H$d%"%I%l%9J}<0$N7hDj
- %Z!<%8%s%0$d%;%0%a%s%H$J$I%a%b%j!<4IM}J}<0
- %Q%$%W%i%$%s@)8f
- CPU $r=|$/%O!<%I%&%'%"HN4XO"$d3HD%@-
- %-%&%C%7%e!&3%R!<%l%s%9$K4X$9$kLdBj$N2r7h

3liNE@$+$iCPU $r@8@.$9k3HObHhjCPU $r<+F0@8@.$9k3HO!"Hs>o$K:$FqG"$k!#$=N?$a!"M=$a$$$/D+$N;vNc$rMQ0U9k3H$,I,MW$G$"$k!#

2.4 4pK\%=%U%H%&%'%"$N<+F0@8@.

4pK\%=%U%H%&%'%"$N<+F0@8@.$H$OCPU $N@-G=$rbH$K%3%s%Q%$%i$dOS $N<+F0@8@.$r9T$&$bNG$"$k!#%7%9%F%`$N%O!<%I%&%'%"9=@.!EJC$K%W%m%;%C%5!K$,JQ99$5$l$k$H!$4pK\%=%U%H%&%'%"$bJQ99$9$kI,MW$,$"$k!#%7%9%F%`@_7W<T$,$$$A$$$A4pK\%=%U%H%&%'%"$r:n@./JQ99$9k?aK$O!"B?Bg$J;~4VrI,MWH9k!#$=$N$?$a4pK\%=%U%H%&%'%"$r<+F0@8@.$9k3H,Ds0F5l$F$$$k!#

6qBNE*KO!$0J2<$N>pJs$+$i4pK\%=%U%H%&%'%"$N@8@.$r9T$&!#

- 3FL?Na$NF0:n
- <B9T%5%$%/%k?t
- 1i;;8lD9
- HFMQ%l%8%9%??t!$IbF0>.?tE@%l%8%9%??t
- %9%?%C%/%]%$%s%?$JINFC<l%l%8%9%?$K4X$9$k>pJs
- %a%b%j$K4X$9$k>pJs

2.5 %O!<%I%&%’%"/%=%U%H%&%’%"$N<+F0J,3d!"<+F0@8@.

%O!<%I%&%’%"/%=%U%H%&%’%"$N<+F0J,3d!"<+F0@8@.$H$O!"CPU $r=|$/FC<lMQES8~$1%7%9%F%`$r$"$k8@8l$G5-=R$7!"$=$l$r;HMQIQEY$d%3%9%H$r9MN8$7$F<+F0E*$KJ,3d!"@8@.9kbNG"$k!#

%=%U%H%&%’%"$N@8@.$K4X7F$O!"%3%s%Q%$%i$+$i<u$1<h$C$?>pJs$rbH$K@lMQ%W%m%;%C%5!"5Z$SFC<dMQES8~$1%O!<%I%&%’%"$GF0:n9kbN$r@_7W$9kI,MW,$"$k!#%O!<%I%&%’%"$N@8@.$K4X7F$O!"5,LO$rG-k@$1:G>.2=$9k3H,2]BjHJ$k!#

3 KITE%^%$%/%m%W%m%;%C%5$N%"!<%-%F%/%A%c9=@.

3.1 %"%I%l%9J}<0

KITE%^%$%/%m%W%m%;%C%5$N%"%I%l%9J}<0$O!"D>@\%"%I%l%9J}<0!"%$%s%G%C%/%9=$>~%"%I%l%9J}<0!"B(CM%"%I%l%9J}<0!"%l%8%9%?D>@\%"%I%l%9J}<0!"4^0U%"%I%l%9J}<0$N5<cN`$,MQ0U5l$F$$$k!#0J2<K3li$N>\:Y$r=RYk!#

[1] D>@\%"%I%l%9J}<0

D>@\%"%I%l%9J}<0$O!"L?Na$N%*%Z%i%s%I$O!"%a%b%j!<6u4V$b$KB8:_$7!"L?Na$N%"%I%l%9It$G%*%Z%i%s%I$N@dBP(12bit $^$?$O!"8bit) %"%I%l%9$r;XDj9k!#

[2] %$%s%G%C%/%9=$>~%"%I%l%9J}<0

%$%s%G%C%/%9=$>~%"%I%l%9J}<0$O!"%$%s%G%C%/%9%l%8%9%?$K3JG<$5lF$$$kCM$KL?Na%l%8%9%?$K3JG<5l$k@0?t%G%#%9%W%l!<%9%a%s%H$r2C$($F!"<B8z%"%I%l%9$H9k!#$?$@$7!"KITE%^%$%/%m%W%m%;%C%5GO!"L?Na$N@0?t%G%#%9%W%l!<%9%a%s%H$O!"8bit 7+;XDjG-$J$$$?$a!"Id9fIU$-$N8bit %G!<%?$H7F07ol$k!#

[3] B(CM%"%I%l%9J}<0

B(CM%"%I%l%9J}<0$O!"L?Na<+?H$NCf$K%*%Z%i%s%I$r7F$$$9$k!#$?$@$7!"KITE%^%$%/%m%W%m%;%C%5$G$O!"L?NaD9$,8GDjG"k?$a!"B(CM$H7F8bit 7+;XDjG-$J$$!#$=$N$?$a!"L?NaKhCF!"B(CM$O!"Id9fIU$-$N16bit %G!<%?!"Id9f$J7N16bit %G!<%?!"$^$?$O!">e0L8bit O9YF%<%m$N16bit %G!<%?$N$$$:l+H7$F07$olk!#

[4] %l%8%9%?D>@\%"%I%l%9J}<0

%l%8%9%?D>@\%"%I%l%9J}<0$O!"%*%Z%i%s%I$O%l%8%9%?Fb$KB8:_$9$k!#%l%8%9%?$H7F$O!"%"%-%e%`%l!<%?!"%9%?%C%/%]%$%s%?!"%$%s%G%C%/%9%l%8%9%?!"%W%m%0%i%`%+%&%s%?$,;XDjG-$k!#

[5] 4^0U%"%I%l%9J}<0

4^0U%"%I%l%9J}<0$O!"%*%Z%i%s%I$O!"L?Na$NDj5A$NCf$G0EL[$N$&$A$K;XDj$5lk!#

3.2 L?Na%;%C%H

KITE %^%$%/%m%W%m%;%C%5$NL?Na%;%C%H$O!"0J2<$N5<oN`$KJ,$1il$k!#

[1] %G!<%?E>AwL?Na

KITE %^%$%/%m%W%m%;%C%5$N%G!<%?E>AwL?Na$O!"%a%b%j!<$H%"%-%e%`%l!<%?4V$N%G!<%?E>Aw!"I/O $H%l%8%9%?4V$N%G!<%?E>Aw!"%l%8%9%?4V$N%G!<%?E>Aw$N3<oN`$,B8:_$9$k!#

[2] J,4tL?Na

KITE %^%$%/%m%W%m$;$C%5$NJ,4tL?NaKO!"L5>r7oJ,4tL?Na$H>r7oJ,4tL?Na$,$"$k!#>r7oJ,4tL?Na$O!"%U%i%0%l%8%9%?$NCM$r;2>H$7$F!"J,4t$r9T$&!#$^$?!"%9%?%C%/$K3JG<7FJ,4t$r9T$&CALL L?Na$H%9%?%C%/!A%^%$%/%m%W%m%;%C%5$N>uBV$rI|5"5;$k%j%?!<%sL?Na$,$"$k!#

[3] 1i;;L?Na

KITE %^%$%/%m%W%m%;%C%5$N1i;;L?Na$O!";;=Q1i;;!"O@M}1i;;!"%7%U%H1i;;!"2sE>1i;;$KJ,$1il$k!#1i;;L?Na$O!"%$%s%G%C%/%9=$>~%"%I%l%9J}<0$N>l9g$H$=$&GJ$$>l9g$G!"=hM}$NN.l,0[Jk

[4] %9%?%C%/L?Na

KITE %^%$%/%m%W%m%;%C%5$N%9%?%C%/L?NaKO!"%l%8%9%?NCMr%a%b%j$K<B8=$5lk%9%?%C%/$K3JG<$9$kPUSH L?Na$H%9%?%C%/$K3JG<$5lF$$$kCM$r%l%8%9%?$KE>Aw9kPOP L?Na$,$"$k!#

[5] %7%9%F%`@)8fL?Na

KITE %^%$%/%m%W%m%;%C%5$N%7%9%F%`@)8f$O!"%^%$%/%m%W%m%;%C%5$NF0:n>uBV$r%[%k%H>uBV$KA+0\$5$;$kHALT L?Na$H2?$b9ToJ$$NOP L?Na$,$"$k!#

3.3 %G!<%?%U%)!<%^%C%H

KITE %^%$%/%m%W%m%;%C%5$OId9fIU$-@0?t%G!<%?7?$HId9fJ7@0?t%G!<%?7?$N2<oN`$r%5%]!<%H7F$$$k!#9YFNId9fIU$-%G!<%?7?$O!"2$NJd?tI=5-$H$_$J$7!"Id9f%S%C%H$O:G>e0L%S%C%HG"$k!#Id9f%S%C%H$,1Ji$P!"$=$N?t$OId$N?t$G$"$k!#Bg$-$5$O!";D$j$N15%S%C%H$GI=5l$k!#

3.4 =hM}>uBV

KITE %^%$%/%m%W%m%;%C%5$N=hM}>uBV$O!"<B9T>uBV$H%[%k%H>uBV$,$"$j!"%^%$%/%m%W%m%;%C%5$,F0:n$7$F$$$kH-$O!"I,$:IAi+$N>uBV$rHk!#

<B9T>uBVHO!"%W%m%0%i%`$r<B9T$7$F$$$k>uBV$G!"0lHL$N%W%m%0%i%`$^$?$O!"%7%9%F%`%W%m%0%i%`$,<B9T5l$F$$$k!#%[%k%H>uBVHO!"%^%$%/%m%W%m%;%C%5$,Dd;_7F$$$k>uBVG"$j!"%j%;%C%H5!G=$rMxMQ9k3HKhCF!"<B9T>uBV$XA+0\$G$-$k!#0J2<$K%[%k%H>uBV$r<($9!#

- %[%k%HL?Na$r<B9T$7$?>l9g
- %^%$%/%m%W%m%;%C%5$H7FF0:n$r3+;O$9$k>uBV
- %j%;%C%HC<;R$,%"%/%F%#%V$G$"$k>uBV

4 HDL Kh$kKITE %^%$%/%m%W%m%;%C%5$N<B8=

4.1 HDL Kh$k%O!<%I%&%'%"@_7W$NN.$l

HDL HO!"2sO)$NF0:n$d9=B$$r5-=R9k$?$a$N8@8l$G$"$j!"2sO)@_7WK*$$$F!"2sO)?^$r=q$/NGOJ$/!"8@8l$KhC$F2sO)F0:n$r5-=R9kbNG"$k!#=>Mh!"2sO)@_7W$O!"4pK\O@M}2sO)$H%U%j%C%W%U%m%C%W$rE,59;HMQ7F!"2sO)?^KhCF@_7W5lF-$?!#$=N?$a!"4pK\O@M}2sO)$d%U%j%C%W%U%m%C%W$K4X$7$F=OCN$7$F$$$kP+jGOJ$/!"4pK\O@M}1i;;$d%+%k%N!<?^$K4X$7Fb@:DL7F$$$kI,MW$,$"C?!#7+$72sO)$NBg5,LO2=$KH<$C$F!"%O!<%I%&%'%"5-=R8@8l!"2sO)%7%_%e%l!<%?5Z$SO@M}9g@.%D!<%k$rMQ$$$?@_7WXHO\9T7F$-$?!#2sO)%7%_%e%l!<%?HO!"HDL $rF~NO$7!"%7%_%e%l!<%7%g%s7k2L$r%&%'!<%V$d%7%0%J%k!&j%9%HH7$F=PNO$7!"2sO)$N@5Ev@-$r3NG'9kbNG"$k!#O@M}9g@.%D!<%k$H$O!"HDL $+$i2sO)?^$r:n@.$9kbNG$"$k!#O@M}9g@.%D!<%k$r;HMQ$9lP!"4pK\O@M}1i;;!"%+%k%N!<?^5Z$S%I!&b%k%,%s$ND;M}$r9MN8$;$:$K!"HDL $+$i!"2sO)?^$r:n@.$9k3H,2DG=G"$k!#

8=:_HDL KO!"0J2<$N4 <oN`$,$"$k!#

[1] VHDL

- JF9q9qKIAm>J0Q0w2q$G1982 G/$KDs>'5l!"1986 G/$KIEEE $GI8=`2=:n6H$r3+;O$7!"1987 G/$K>5G'5l$?
- JF9q9qKIAm>JD4C#$NASIC $O!"VHDL GN5-=R$,5AL3IU$1il$F$$$k
- O@M}9g@.$rL\E*$?7?5-=RP+jGJ/!"%7%9%F%`F0:n$N%7%_%e%l!<%7%g%s5-=R$b2DG=G"$k

[2] Verilog-HDL

- 1985 G/$KCadence <R$,3+H/$7!"1995 G/$K>5G'5l$?
- F |K\!"5Z$SJF9q$G$O!"VHDL hjIa5Z7F$$$k
- %7%9%F%`5-=RG=NO$O!"VHDL $[$I9b$/$J$$

[3] SFL

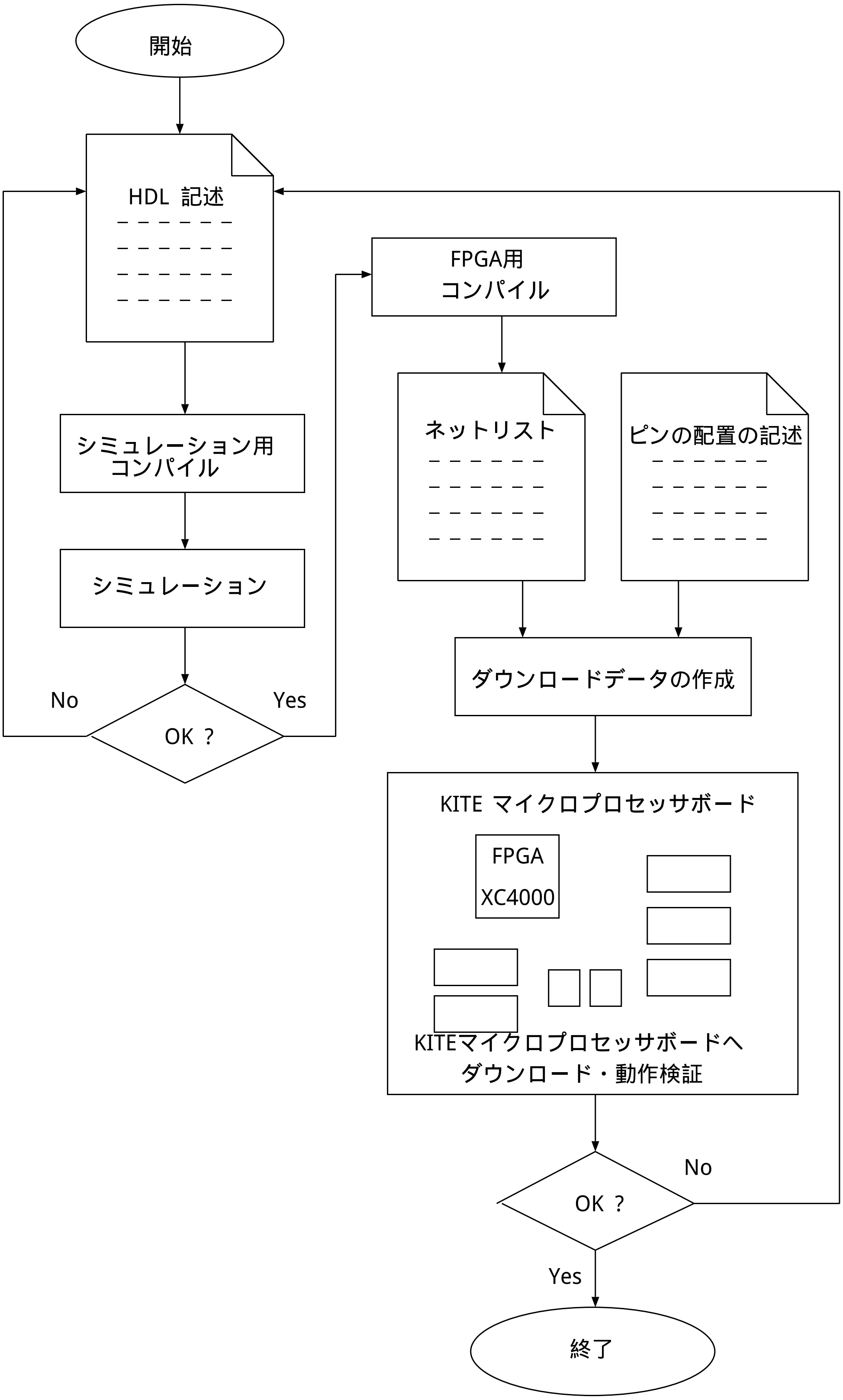
- NTT $,3+H/$7$?PARTHENON %7%9%F%`$G;HMQ9k
- NTT!"5Z$S0lIt$NBg3X$N8&5f<<$G;HMQ2D
- 2sO)9=@.$,40A4F14|<0$N$_$r%5%]!<%H
- RTL 5-=RN_$r%5%]!<%H

[4] UDL/I

- F |K\EE;R9)6H?66=6 (2q$,1990 G/$+$i3+H/
- 1996 G/$K%U%j!<!&=%U%H%&%'%"$H7F!"%=!<%9%3!<%I$r4^$'9YF,8x3+5l$?
- RTL 5-=RN_$r%5%]!<%H

K\8&5fGO!"Bh3 >O$G=R$Y$? KITE %^%$%/%m%W%m%;%C%5$r VHDL $G:n@.$7!"$=$l$r FPGA(XC4010) $K%j%?!<%2%C%H$9k3HrL\I8H9$k!#FPGA HO!"Field Programmable Gate Array $NN,$G!"2?EYGb=q49$(2DG=$J SRAM %Y!<%9$N%2!<%H%"%l%$$NO1l<oG"$k!# FPGA $O8=:_$NH3$m?t@i!A?tK|%2!<%H$r<}MFG-kbN,HNGd5l$F$$$k!#

HDL Kh$k6qBNE*$J@_7W$NN.$l$r?^2$K<($9!#$^$:!"VHDL $G2sO)5-=R$7!"$=$l$r%7%_%e%l!<%7%g%s$9$k!#%7%_%e%l!<%7%g%s$G@5>oF0:n$,3NG'$5l?$i!"O@M}9g@.%D!<%k$r;HMQ7F%M%C%H%j%9%H$r:n@.$9$k!#<!$K!"%T%sG[CV>pJs%U%!%$%k$r5-=R9k!#3l$O!"HDL 5-=R$5l?%G%6%$%s$NF~=PNO%]!<%H$H FPGA $N%T%s$r@\B3$9$kbNG"$k!#$5iK!"%M%C%H%j%9%H$r FPGA $K<BAu2DG=$J7A<0$XJQ49$9$k!#:G8e$K FPGA $X%@%&%s%m!<%I$7!"F0:n8!>Z$r9T$&!#



?^2: FPGA XN<BAu<j=g

4.2 %l%8%9%?It

KITE %^%$%/%m%W%m%;%C%5$K$Q, L?Na%l%8%9%?, %"%-%e%`%l!<%?, %W%m%0%i%`%+%&%s%?, %$%s%G%C%/%9!&%l%8%9%?, %9%?%C%/%]%$%s%?, %"%I%l%9%l%8%9%?, %U%i%0%l%8%9%?$,MQ0U$5lF$$$k. %W%m%0%i%`%+%&%s%?$O%+%&%s%H%"%C%W$9$k5!G=$,$D$$$F$$$k. F1MM$K%9%?%C%/%]%$%s%?$d%$%s%G%C%/%9%l%8%9%?Kb1i;;5!G=$r2C$(k3Hb9M$($ilk$,, 2sO)5,LO$,Bg$-$/Jj, @)8f2sO)$N4JN,2=$bK>aJ$$$?$a, ALU $rMQ$$$F1i;;$r9T$&. 3F%l%8%9%?$O@)8f?.9f CB KhCF%j%;%C%H$d%U%'%C%A$NF0:nr9$k. I=1$K%l%8%9%?9=@.$r<($9

I=1: %l%8%9%?9=@.

%l%8%9%?L>	D9$5	CB(1)	CB(2)	CB(3)
ACC,IR	16bit	%j%;%C%H	write	
AR	16bit	%;%C%H	write	
SP,IXR	12bit	%j%;%C%H	write	
FR	4bit	%j%;%C%H	write	
PC	12bit	%j%;%C%H	write	%$%s%/%j%a%s%H

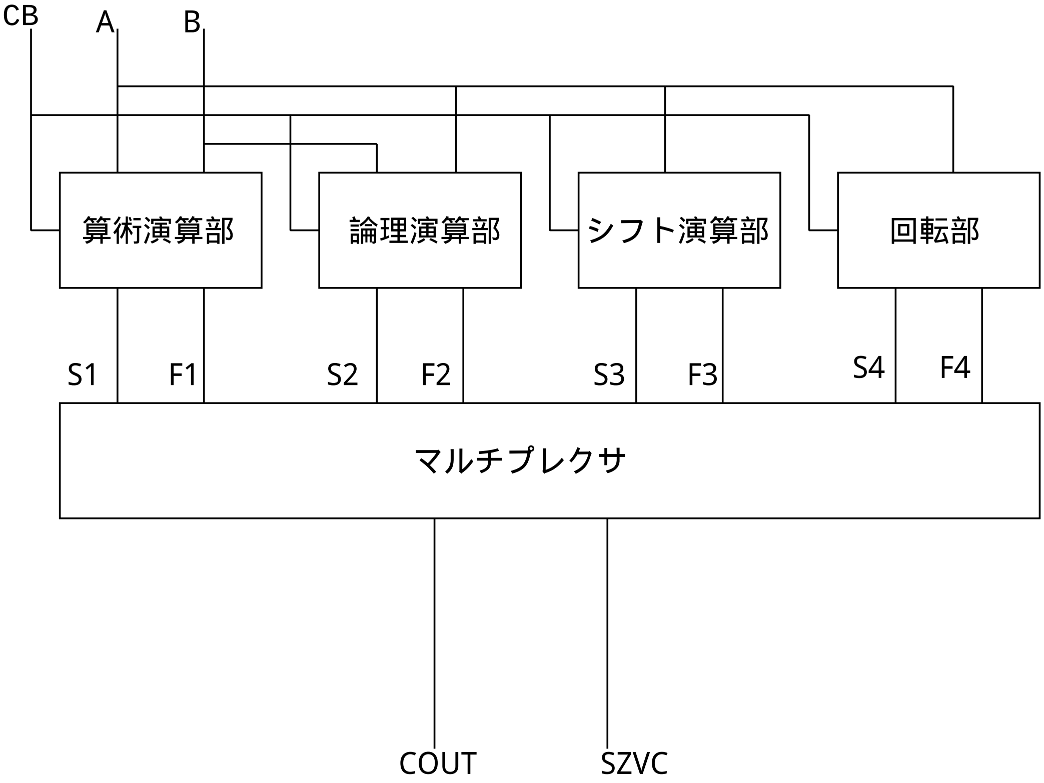
4.3 ALU It

KITE %^%$%/%m%W%m%;%C%5$NALU $O!"16bit $N1i;;$r9T$&$3H,G-$k. ALU $N5!G=$H7F$O!";;=Q1i;;!"O@M}1i;;!"%7%U%H1i;;!"2sE>1i;;$,$"$k!#$^$?!"$=$N1i;;7k2L$rH?1G7F!">uBV%U%i%0$r=PNO$9$k!#ALU $,=PNO$9$k%U%i%0$O!"Id9f%U%i%0!"Nm%U%i%0!"%*!<%P!<%U%m!<%U%i%0!"%-%c%j!<%U%i%0$N4$DG"$k. $^$?!"ALU $O1i;;L?Na;~$NB>$K!"%"%I%l%91i;;$K$b;HMQ$5lk!#

ALU $O1i;;?t!"Ho1i;;?t!"<1JL%3!<%I$NF~NO$KhC$F!"1i;;7k2L!"5Z$S>uBV%U%i%0$r=PNO$9kbNG$"$k. $?$@$7!"1i;;BP>]$,1DG$h$$>l9g$O1i;;?t$O!"L5;k5l$k!#

;;=Q1i;;It$NFbIt9=@.$O!"?^3$K<($9h&$KJBNs@\B3$5lF$$$k!#6bit $N<1JL%3!<%I$N$&$A!"2<0L$N2bit NCMr<u1F!"3F1i;;It$O5!G=$r;Oak!#3F1i;;It$N1i;;7k2L$O, %^%k%A%W%l%/%5KEO5$l!"$=3G>e0L4bit NCMr<u1F!"BP>]HJ$k1i;;It$r7hD<j$7!"CM$r=PNO9k!#>uBV%U%i%0$K4X$7FO!"%-%c%j!<%U%i%0!"%*!<%P!<%U%m!<%U%i%0$O!"3F1i;;It$+$i=PNO$5lk!#$^$?!"Id9f%U%i%0!"Nm%U%i%0$O!"%^%k%A%W%l%/%5$N7k2LrF'^$($F@8@.5l$k!#

3F1i;;It$N5!G=$rI=2$K<($9!#



?^3: ALU $NFbIt;EMM

I=2: ALU $N5!G=

;;=Q1i;;It	O@M}1i;;It	%7%U%H1i;;It	2sE>It
2C;;	O@M}OB	O@M}:8%7%U%H	:82sE>
8:;;	GSB>E*O@M}OB	;;=Q:8%7%U%H	1&2sE>
%$%s%/%j%a%s%H	O@M}@Q	O@M}1&%7%U%H	%P%$%H%9%o%C%W
%G%/%j%a%s%H	O@M}H]Dj	;;=Q:8%7%U%H	%Q%9

4.4 L?Na%G%3!<%@It

L?Na%G%3!<%@$O!"L?Na%l%8%9%?$H%U%i%0%l%8%9%?$N>uBV$r;2>H$7!"%7!<%1%s%5$K!"8=:_<B9T5l$F$$$kL?Na$N>pJs$rE>Aw9k!#6qBNE*KO!"0J2<$K<($9>pJs$rE>Aw$9$k!#

- L?Na$N<oN`
- %"%I%l%9J}<0
- J,4t>r7o
- 3JG<@h!"6!5k85%l%8%9%?
- Id9f%S%C%H

L?Na$N<oN`$G$O!"8D!9$NL?Na$NB>$K!"L?Na%0%k!<%W$K4X$9$k>pJs$r@8@.$9$k!#L?Na%0%k!<%W$O!"%$%s%G%C%/%9=$>~1i;;L?Na!"%$%s%G%C%/%9=$>~$r=|$/1i;;L?Na!"%G!<%?E>AwL?Na!"CALL L?Na!"%7%9%F%`@)8fL?Na$N5<oN`G"$k!#%"%I%l%9J}<0$K4X7F$O!"8=:_<B9T$5lF$$$kL?Na$,!"D>@\%"%I%l%9J}<0!"%$%s%G%C%/%9=$>~%"%I%l%9J}<0!"B(CM%"%I%l%9J}<0!"%l%8%9%?D>@\%"%I%l%9J}<0!"4^0U%"%I%l%9J}<0NIlG$"$k$+$rH=CG9k!#J,4t>r7o$K4X$7FO!"J,4tL?Na$N:]$K%U%i%0%l%8%9%?$N>pJs$rbH$K!"J,4t$NM-L5$rH=CG$9kbNG$"$k!#3JG<@h!"6!5k85%l%8%9%?$K4X$7FO!"%l%8%9%?D>@\%"%I%l%9J}<0$,<B9T$5lF$$$k:]$K!"$=$N%l%8%9%?$K4X9k>pJs$r@8@.$9$k!#Id9f%S%C%H$K4X7F$O!"%$%s%G%C%/%9=$>~%"%I%l%9J}<0$,E,MQ5l$F$$$k:]$O!"@0?t%G%#%9%W%l!<%9%a%s%H$NId9f!"$^$?!"B(CM%"%I%l%9J}<0$,E,MQ5l$F$$$k>l9g$O!"B(CM$NId9f$r@8@.$9$k!#

4.5 %7!<%1%s%5It

%7!<%1%s%5$O!"%^%$%/%m%W%m%;%C%5$NF0:n$r$r;J$kCf?4E*$J2sO)$G!"L?Na%G%3!<%@$HF~NO%]!<%H$JIN30It$N<~JU5!4o$+iN>pJsrbHK3F%l%8%9%?$d%a%b%j!<$K%"%/%;%9$9$k$?$a$N=hM}$r9T$&!#

%7!<%1%s%5KBP9$k30It$N<~JU5!4o$+$i$NF~NO$O!"%j%;%C%H$H%"%/%N%j%C%8$G$"$k!#%j%;%C%HF~NO$,$5l?>l9g!"%7!<%1%s%5$N>uBV$r=i4|2=9k!#$^$?3F%l%8%9%?KBP7$F!"%j%;%C%HL?Na$r=PNO9k!#%"%/%N%j%C%8$,F~NO$5lk$H!"%a%b%j!<Kt$O!"=PNO%]!<%H$K%G!<%?%P%9$NCM$r=PNO$9$k!#

KITE %^%$%/%m%W%m%;%C%5$N%7!<%1%s%5$O!"L?Na%0%k!<%W$KhC$F!"0J2<$K<($97 DN>uBV$KBgJL$5lk!#

[1] %j%;%C%H

%j%;%C%H>uBV$O!"%j%;%C%H%9%$%C%A$,%$%s%"%/%F%#%V$N>uBV$G$"$k!#

[2] %Y%/%H%k%9%?!<%HIt

%Y%/%H%k%9%?!<%HIt$O!"%j%;%C%H>uBV$,=*N;9k$H!"%a%b%j!<6u4V$N0xFFFF HVCO $N%G!<%?$r%W%m%0%i%`%+%&%s%?$K=PNO$9$k!#

[3] L?Na%U%'%C%AIt

L?Na%U%'%C%AIt$O!"%W%m%0%i%`%+%&%s%?$NCM$r%"%I%l%9%l%8%9%?$KE>Aw$7!"%W%m%0%i%`%+%&%s%?$NCM$r%$%s%/%j%a%s%H9k!#$=$N8e%"%I%l%9%l%8%9%?$N<($9%G!<%?$rL?Na%l%8%9%?$KE>Aw9k!#

[4] %"%I%l%91i;;It

%"%I%l%91i;;It$O!"<B8z%"%I%l%9$d@dBP%"%I%l%9$r%"%I%l%9%l%8%9%?$K3JG<9k@)8f$r9T$&!#

[5] %"%/%;%9It

%"%/%;%9It$O!"%a%b%j!<6u4V$dIO 6u4V$K%"%/%;%9$9k?aN@)8fItG"$k!#

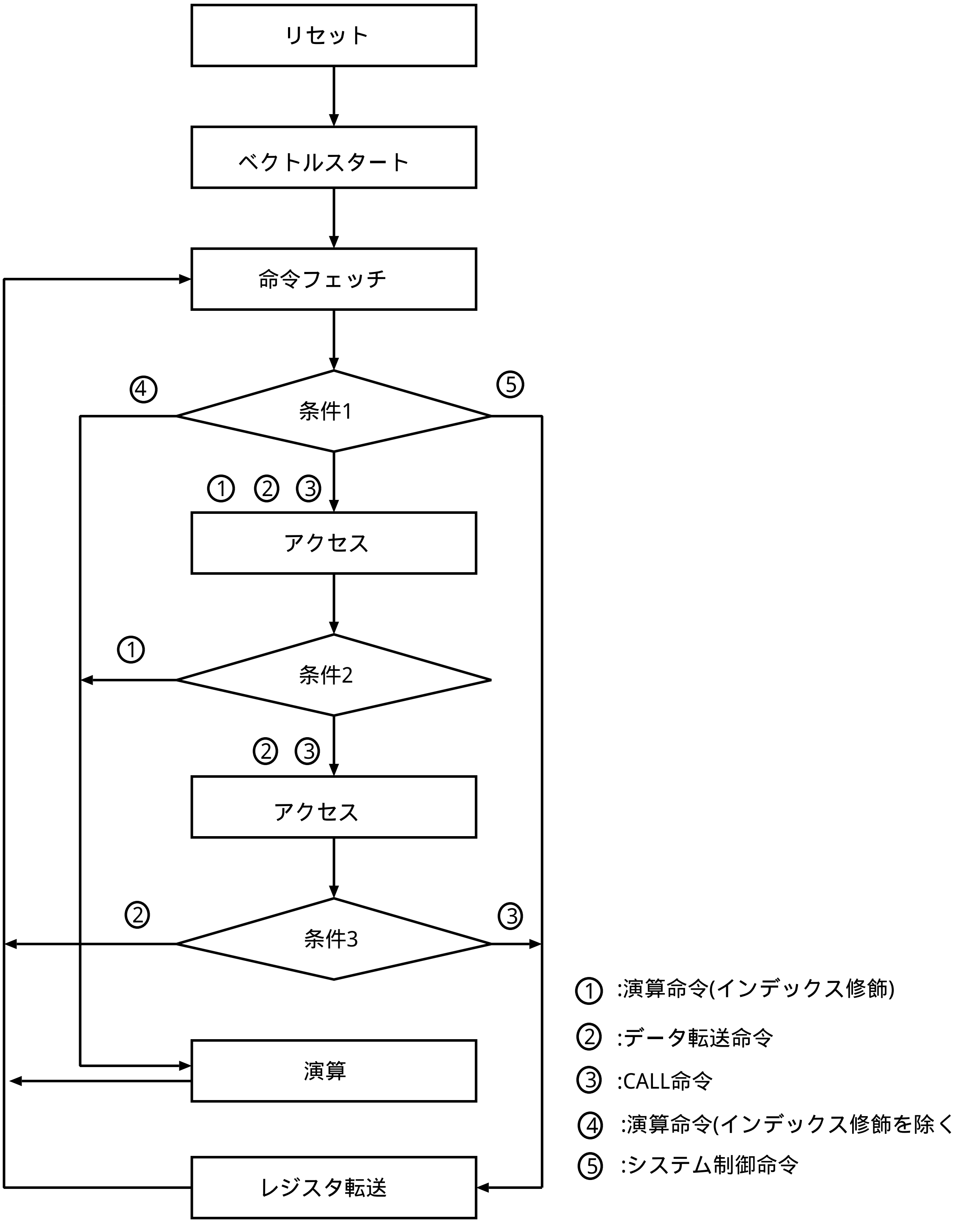
[6] 1i;;It

1i;;It$O!"1i;;L?Na$KhC$F;XDj$5l?1i;;$r9T$&!#

[7] %l%8%9%?E>AwIt

%l%8%9%?4V$G%G!<%?$rE>Aw9k$?$a$N@)8f$r9T$&!#

%7!<%1%s%5$N%j%;%C%H!"%Y%/%H%k%9%?!<%H0J30$N>uBVA+0\$O!"L?Na%G%3!<%@$+$iM?$($ilkL?Na%0%k!<%W$N>pJs$KhC$F!"A*Br$5lk!#$^$?!"L?Na%0%k!<%WKh$k%7!<%1%s%5$N>uBVA+0\$r?^4$K<($9[4]!#



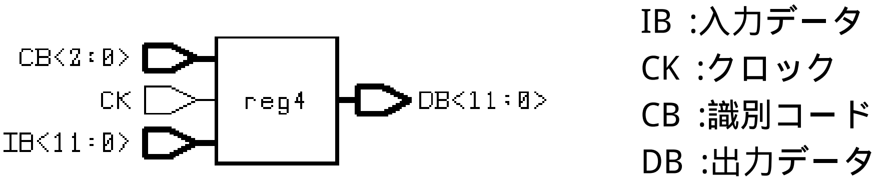
?^4: %7!<%1%s%5$N>uBVA+0\

5 <B83$H9M;!

5.1 3FIt$N%F%9%H

:#2s$N<B83$G$O!"%7!<%1%s%5$,L$40@.$N$?$a!"%^%$%/%m%W%m%;%C%5$rF0:n5;k3HOG-J+C?$,!"%1%8%9%?It!"ALU It!"L?Na%G%3!<%@It$K4X$7FO$"$kDxEY%F%9%H$r9T$&3H$,$G$-$?!#

%1%8%9%?It$K4X$7FO!"%7%_%e%l!<%?GN%F%9%H!"5Z$S!"KITE %^%$%/%m%W%m%;%C%5>eGN%F%9%H$r9T$C$?!#%1%8%9%?$N%7%_%e%l!<%7%g%sNNcH7F!"%W%m%0%i%‘%+%&%s%?$r<h$j>e2k!#%W%m%0%i%‘%+%&%s%?$O!"DL>o$N%1%8%9%?$N5!G=$K2C$($F%$%s%/%j%a%s%H$N5!G=$,IU2C$5lF$$$k!#%W%m%0%i%‘%+%&%s%?$N30It;EMM$r?^5$K<($9!#$^$?!"%W%m%0%i%‘%+%&%s%?$N<1JL%3!<%I$rI=3$K<($9!#<1JL%3!<%ICB $O!"$$$:l+NCM,1 G"k+!"9YFNCM$,0 G"k+NIAi$+G"$k!#



?^5: PC $N30It;EMM

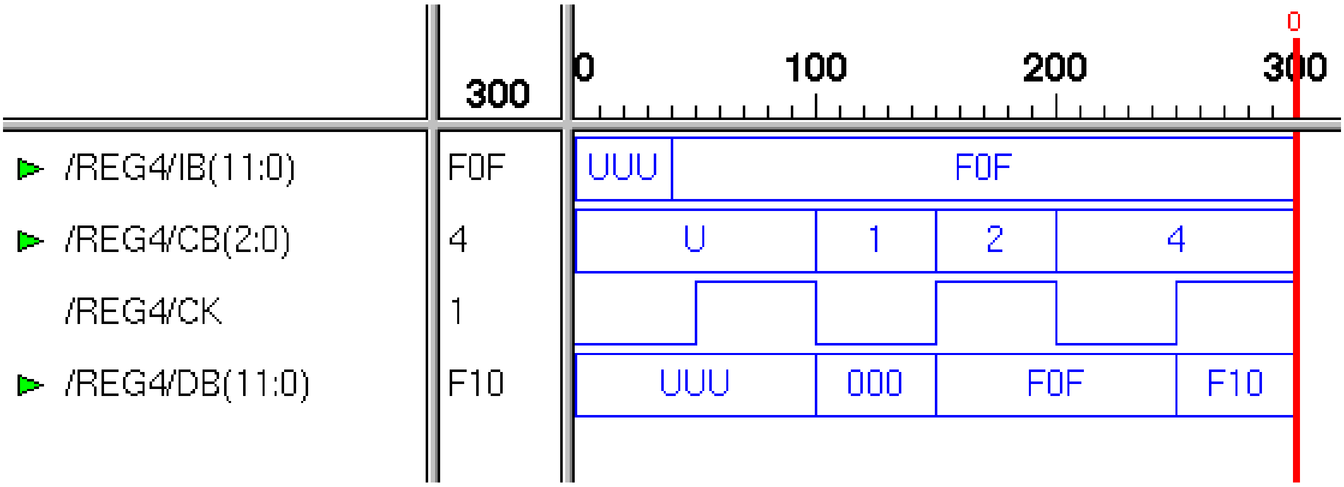
I=3: PC $N<1JL%3!<%I

CB(2)	CB(1)	CB(0)
%$%s%/%j%a%s%H	write	%j%;%C%H

%W%m%0%i%‘%+%&%s%?$O!"12bit $NHsF14|%j%;%C%H!"F14|FI$_9~$_%1%8%9%?$G$"$k!#CB $,0x1 KJkH!"DB $O%/%m%C%/$K4Xoi$:0x000 $r=PNO$9$k!#$^$?!"CB(0) $,0x2 KJkH!"DB $OIB NCMr=PNO9k!#CB $,0x4 KJkH!"DB NCMr%$%s%/%j%a%s%H9k!#%W%m%0%i%‘%+%&%s%?$N%7%_%e%l!<%7%g%s7k2L$r?^6$K<($9!#

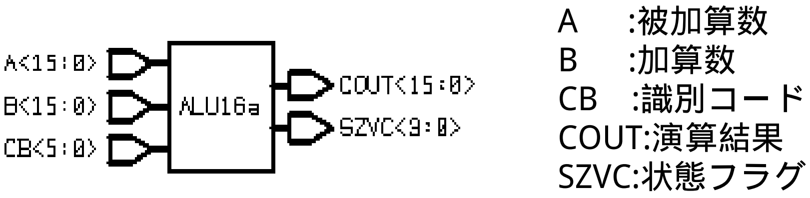
?^6GO!"$^$:!"3FCM$O=i4|CMU’$r<(7F$$$k!#50 ns $GIB $KF0F $,F~NO$5lk!#100 ns $GCB $,0x1 KJ$j!"DB NCM,%j%;%C%H5l$k!#150 ns $G%/%m%C%/$,N)$A>e$,$j!"$+$DCB $,0x2 KJ$jIB NCM,DB KFI_9~$^$l$k!#200 ns $GCB $,0x4 KJk,!"%/%m%C

%/$NN)$A>e$,$jGO$J$$$N$G!"DB $O!"JQ2=$7$J$$!#250 ns $G%/%m%C%/$,N)$A>e$,$j!"DB NCMO!"%$%s%/%j%a%s%H$5lk!#%l%8%9%?$O!"%W%m%0%i%`%+%&%s%?$r=|$/$bNK4X7F$b!"@5>o$KF0:n9k3H$r3NG'7?!#



?^6: PC $N>uBVA+0\

ALU $K4X$7FO!"%7%_%e%l!<%?Kh$k%F%9%H$r9TC?!#ALU 30It;EMM$r?^7$K<($9!#$^$?!":8;;=Q%7%U%H$O!"KITE %^%$%/%m%W%m%;%C%5$H:n@.7?%^%$%/%m%W%m%;%C%5$HGO!"0[JC$?F0:n$r9k!#ALU $K4X$7FO!"%7%_%e%l!<%?GO!"@5>o$KF0:n$9k3Hr3NG'7?!#



?^7: ALU $N30It;EMM

:8;;=Q%7%U%H$O!"KITE %^%$%/%m%W%m%;%C%5$H:n@.$7$?%^%$%/%m%W%m%;%C%5HG$O!"0[JC$?F0:n$r9k!#$=$NM}M3$r0J2<$K=RYk!#

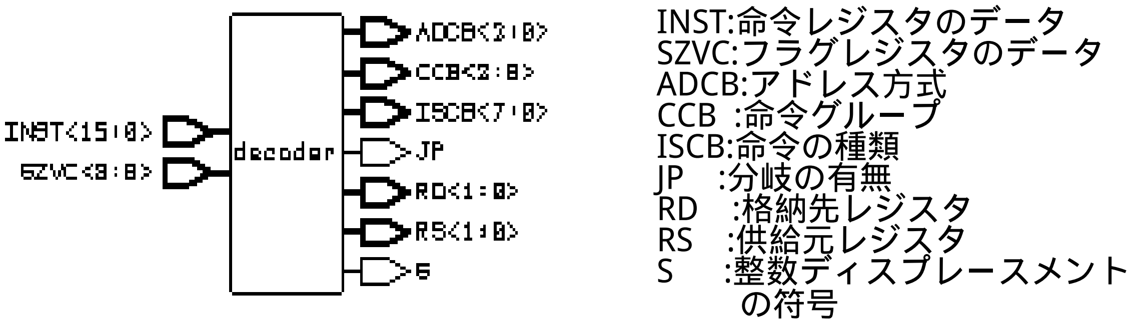
- ;;=Q1i;;GO!"DL>o!"Id9f%S%C%H$OH?E>$7$J$$$?$a!#
- ;;=Q:8%7%U%H$O<B:]$K$O!"CPU H7FN5!G=>eOI,MWJ$$$?$a!"JQ99$KhkBg$-$J 1F6A$,$J$$$HH=CG7?!#
- JQ99$NI,MW@-$,=PF-$?>l9g!"COUT(15) <= COUT(15) xor V KhCF4JC1$K KITE-I $N;EMM$KJQ99G-$k!#

$^$?!"F0:n$N0c$$$rI=4$K<($9!#

I=4: :8;;=Q%7%U%H$N0c$$

	A	COUT	SZVC
KITE-I	0101010101010101	1010101010101010	1010
My-ALU	0101010101010101	0010101010101010	0010

L?Na%G%3!<%@$K4X$7FO!"%7%_%e%l!<%?Kh$k%F%9%H$NB>$K!"0lIt KITE %^%$%/%m%W%m%;%C%5>eGN%F%9%H$r9T$C$?!#L?Na%G%3!<%@$K4X7F$O!"%7%_%e%l!<%?$Khk%F%9%HGO!"@5>o$KF0:n$9k3Hr3NG'7?!#$^$?!"KITE %\!<%IGb%F%9%H7?%G!<%?$O!"@5>o$KF0:n9k3H$r3NG'$7$?!#L?Na%G%3!<%@$N30It;EMM$r?^8$K<($9!#



?^8: L?Na%G%3!<%@$N30It;EMM

5.2 KITE %^%$%/%m%W%m%;%C%5$G$N%O!<%I%&%'%"/%=%U%H%&%'%"!&%3%G%6%$%s$N9M;!

8=:_!"%^%$%/%m%W%m%;%C%5$O!"$^$@L$40@.$@$,!":#$^GN7P83rF'^$($FKITE %^%$%/%m%W%m%;%C%5%\!<%I PLUS+$rMQ$$$?!"%O!<%I%&%'%"/%=%U%H%&%'%"!&%3%G%6%$%s$K4X7F9M;!9k!#

K\8&5f$N2]Bj$O!"%7%9%F%`3+H/$N<j=g$r<BA)9k3HKhCF!"M}2r$r?<$ak3HG$"$k!#$=$N$?$a$K!"$^$:!"CPU $N<+F0@8@.$N<B8=$K4X$7$F=R$Y$k!#CPU $N<+F0@8@.$K4X7F$O!"L?Na%;%C%H$d!"%S%C%HD9rG0U$K@_Dj$G$-$kh&K7$?$$$H9M$($F$$$k!#L?Na%;%C%H$K4X$7FO!"$"$kDxEY!";vNc$rEPO?$7!"$=$l$rMxMQ$7$F<B8=$7$?$$!#$^$?!"MMU $d!"IO%]!<%H%"%/%;%9$K4X7F$O!"%a%b%j!<9=@.$,%"%I%l%9I}(16bit)!"%G!<%?I}(16bit) HJCF$$$k3H$rN10U$7$F!"@_7W$9kI,MW,$"$k!#

CPU <+F0@8@.$N<!$O!"%3%s%Q%$%i$N<+F0@8@.$r9T$&!#%3%s%Q%$%i$N<+F0@8@.$O!"CPU $NHDL %=!<%9%W%m%0%i%`$rF~NO9k3HKhCF!"%"!<%-%F%/%A%cKBP7$F!":GE,$J%3%s%Q%$%i$r:n@.9kN,L\E*G"$k!#:n@.$7$?CPU $GF0:n3NG'$9k?aK$O!"%@%&%s%m!<%I%G!<%?$r:n@.9k%3%s%Q%$%i$b:n@.9kI,MWHJ$k!#

6 $*$ojK

K\O@J8GO!"KITE %^%$%/%m%W%m%;%C%5$rMQ$$$?%O!<%I%&%'%"/%=%U%H%&%'%"!&3%G%6%$%s$r<B8=9k$?$a$K!"VHDL Kh$k%^%$%/%m%W%m%;%C%5$N<B:]$K:n@.9k2aDx!"5Z$S!"8=:_$N?J9T>u67$K4X7F=RY?!#$^$?!":#8e$N%O!<%I%&%'%"/ %=%U%H%&%'%"!&3%G%6%$%s$X$NJ}8~@-$r=RY?!#

:#8e$N2]Bj$H7F$O!"$^$:!"$^$@L$40@.$N%^%$%/%m%W%m%;%C%5$N%7!<%1%s%5It$N:n@.$r9T$&!#%^%$%/%m%W%m%;%C%5$K4X7F$O!"%Q%$%W%i%$%s@)8f$d!"%Z!<%8%s%0$d%;%0%a%s%H$JIN9M$($r<h$jF~$lk3Hb:#8e$N2]Bj$H8@$($k!#$^$?!"KITE %^%$%/%m%W%m%;%C%5$H$O!"A4$/JL$N%*%j%8%J%k$N%^%$%/%m%W%m%;%C%5$r:n@.9k3H$b!"0l$D$N2]Bj$G$"$k!#

%=%U%H%&%'%"$N@_7W$K4X7F$O!"CPU $N<+F0@8@.$H%3%s%Q%$%i$N<+F0@8@.$r9T$&%=%U%H%&%'%"$r:n@.$7$?$$$H9M$($F$$$k!#7+$7!"N><T$HbK6aG/!"8&5f5l$F$$$J$,$i$bK~B-$J7k2L$rF@$ilF$$$J$$8=>uG"kN$G!"@-G=$K4X9k3Hhj$b%3%G%6%$%s$NN.$l$r0lDL$j<BA)9k3H$rL\E*$H7?$$!#

$=$NB>KO!"ASIC $r<B:]$K:n@.7F$_$?$$$H9M$($F$$$k!#

<U<-

K\8&5f$N5!2q$rM?$($F$/$@5j!"J*$+$D?t!9$N8f=u8@$rD:$-$^7?!";3:j>!9065<x$K?<$/46<U$N0U$rI=7^$9!#$^$?!"$3l^$G?t!9$N8f=u8@$rD:$-$^$7$?8&5f<<$N3'MM$K46<UCW$7$^$9!#

5i$K!"$*K;$7$$Cf!"MM!9$J<ALd$KEz$($F$/$@5C$?Tran So Cong @hGZ$K?<$/46<UCW$7$^$9!#

;29MJ88%

[1] D9C+@nM563: VHDL Kh$k%O!<%I%&%'%"@_7WF~Lg!"CQ =PHG<R!"Feb.1995

[2] J.Bhasker: A VHDL Primer VHDL 8@81F~Lg!"CQ =PHG<R!"Oct.1991

[3] KITE %^%$%/%m%W%m%;%C%5%\!<%I PLUS+ <h07@bL@=q Version1.00!"6e=#7WB,4o3t<02q<R!"Apr.1995

[4] KITE %^%$%/%m%W%m%;%C%5%j%U%!%l%s%9!&%^%K%e%"%k Version1.00!"6e=#7WB,4o3t<02q<R!"1993

[5] %[%9%H%$%s%?!<%U%'!<%9%\!<%I<h07@bL@=q(Ver.1.00)!"6e=#7WB,4o3t<02q<R!"Mar.1995

[6] KITE %^%$%/%m%W%m%;%C%5!&%/%m%9%=%U%H%&%'%"%f!<%6!<%:!&%^%K%e%"%k Version 2.0(;CDjHG)!"6e=#7WB,4o3t<02q<R!"Aug.1995

[7] B<2,MN01,@P0f5HI':CAD Kh$k%^%$%/%m!&W%m%;%C%5$N@_7W!"%5%$%(%s%9<R!"Apr.1995

[8] J.Staunstrup,W.Wolf(Eds.):Harduare/Software Co-Design!"Kluwer Academic Publishers!"1997

[9] :#0f@5<#,>>1JM42p,0B1:42?M>pJs=hM} Vol.36 No.7!">pJs=hM}3X2q!"Jul.1995

[10] Cf9,@/:%H%i%s%8%9%?5;=Q12!"VHDL Kh$k%m%8%C%/@_7WF~Lg!"CQ =PHG<R!"Dec.1997

[11] 0B1:42?M>pJs2J3XN?aN650iMQ%^%$%/%m%W%m%;%C%5%7%9%F%`$N3+H/!"6e=#Bg3XAm9gM}9)3X8&5f2J!"Mar.1996