**Text S6: R coding of Stat-POE and Func-POE models**

**For the Stat-POE model:**

dat<-read.table("inputfile1",header=F,sep = " ") #input genotype data

dat\_T<-read.table("inputfile2",header=F,sep = " ") #input phenotype data

L<-matrix(NA,MKN,8) #MKN as total marker number

colnames(L)<-c("R.coef","a1.coef","a2.coef","d.coef","R.pva","a1.pva","a2.pva","d.pva")

for(i in 1:MKN) {

 Ss<-matrix(NA,4,4)

 V<-matrix(NA,$SAMPN,4)

 n11<-length(which(dat[,i]==1)) # for genotype 11

 n12<-length(which(dat[,i]==2)) # for genotype 12

 n21<-length(which(dat[,i]==3)) # for genotype 21

 n22<-length(which(dat[,i]==4)) # for genotype 22

 p11<-n11/$SAMPN

 p12<-n12/$SAMPN

 p21<-n21/$SAMPN

 p22<-n22/$SAMPN

 N1<-p21+p22

 N2<-p12+p22

 detA<-p12\*p21\*p22+p11\*p21\*p22+p11\*p12\*p22+p11\*p12\*p21

 Ss[,1]<-1

 Ss[1,2]<--(N1+N2)\*(0.5)

 Ss[2,2]<-0.5-(N1+N2)\*(0.5)

 Ss[3,2]<-0.5-(N1+N2)\*(0.5)

 Ss[4,2]<-1-(N1+N2)\*(0.5)

 Ss[c(1,4),3]<-(N1-N2)\*0.5

 Ss[2,3]<-0.5+(N1-N2)\*0.5

 Ss[3,3]<--0.5+(N1-N2)\*0.5

 Ss[1,4]<-(-2)\*p12\*p21\*p22/detA

 Ss[2,4]<-2\*p11\*p21\*p22/detA

 Ss[3,4]<-2\*p11\*p12\*p22/detA

 Ss[4,4]<-(-2)\*p12\*p21\*p11/detA

 V[which(dat[,i]==1),]<-matrix(rep(Ss[1,],n11),nrow=n11,byrow=TRUE)

 V[which(dat[,i]==2),]<-matrix(rep(Ss[2,],n12),nrow=n12,byrow=TRUE)

 V[which(dat[,i]==3),]<-matrix(rep(Ss[3,],n21),nrow=n21,byrow=TRUE)

 V[which(dat[,i]==4),]<-matrix(rep(Ss[4,],n22),nrow=n22,byrow=TRUE)

 regdat<-data.frame(cbind(dat\_T[,i],V[,2:4]))

 fit\_logit<-lm(X1~X2+X3+X4,data=regdat)

 SMR<-summary(fit\_logit)

 for(j in 1:4){

 L[i,j]<-SMR$coef[j,1]

 L[i,j+4]<-SMR$coef[j,4]

 }

}

 write.table(L,"StatPOE\_output.txt",row.names=FALSE,col.names=TRUE)

**For the Func-POE model:**

for(i in 1:MKN) {

 N1<-length(which(dat[,i]==1))

 N2<-length(which(dat[,i]==2))

 N3<-length(which(dat[,i]==3))

 N4<-length(which(dat[,i]==4))

 a1<-dat[,i]

 a2<-dat[,i]

 d<-dat[,i]

 a1[which(dat[,i]==1)]<-c(rep(0,N1))

 a1[which(dat[,i]==4)]<-c(rep(1,N4))

 a1[which(dat[,i]==2|dat[,i]==3)]<-c(rep(0.5,N2+N3))

 a2[which(dat[,i]==1|dat[,i]==4)]<-c(rep(0,N1+N4))

 a2[which(dat[,i]==2)]<-c(rep(0.5,N2))

 a2[which(dat[,i]==3)]<-c(rep(-0.5,N3))

 d[which(dat[,i]==2|dat[,i]==3)]<-c(rep(1,N3+N2))

 d[which(dat[,i]==1|dat[,i]==4)]<-c(rep(0,N1+N4))

 regdat<-data.frame(cbind(dat\_T[,i],a1,a2,d))

 fit\_logit<-lm(V1~a1+a2+d,data=regdat)

 SMR<-summary(fit\_logit)

 for(j in 1:4){

 L[i,j]<-SMR$coef[j,1]

 L[i,j+4]<-SMR$coef[j,4]

 }

}

 write.table(L,"FuncPOE\_output.txt",row.names=FALSE,col.names=TRUE)