```
      SUBROUTINE amebsa(p,y,mp,np,ndim,pb,yb,ftol,funk,iter,temptr)
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      INTEGER iter,mp,ndim,np,NMAX
      DOUBLE PRECISION ftol,temptr,yb,p(mp,np),pb(np),y(mp),funk
      PARAMETER (NMAX=200)
      EXTERNAL funk
      INTEGER i,idum,ihi,ilo,inhi,j,m,n
      DOUBLE PRECISION rtol,sum,swap,tt,yhi,ylo,ynhi,ysave,yt,
     #                 ytry,psum(NMAX),amotsa,ran1
      COMMON /ambsa/tt,idum
      tt=-temptr
1     do   n=1,ndim
          sum=0.d0
          do   m=1,ndim+1
              sum=sum+p(m,n)
          enddo
          psum(n)=sum
      enddo
2     ilo=1
      inhi=1
      ihi=2
      ylo=y(1)+tt*log(ran1(idum))
      ynhi=ylo
      yhi=y(2)+tt*log(ran1(idum))
      if(ylo.gt.yhi)then
         ihi=1
         inhi=2
         ilo=2
         ynhi=yhi
         yhi=ylo
         ylo=ynhi
      endif
      do   i=3,ndim+1
          yt=y(i)+tt*log(ran1(idum))
          if(yt.le.ylo)then
             ilo=i
             ylo=yt
          endif
          if(yt.gt.yhi)then
             inhi=ihi
             ynhi=yhi
             ihi=i
             yhi=yt
          else if(yt.gt.ynhi)then
             inhi=i
             ynhi=yt
          endif
      enddo
      rtol=2.d0*abs(yhi-ylo)/(abs(yhi)+abs(ylo))
      if(rtol.lt.ftol.or.iter.lt.0)then
         swap=y(1)
         y(1)=y(ilo)
         y(ilo)=swap
         do   n=1,ndim
             swap=p(1,n)
             p(1,n)=p(ilo,n)
             p(ilo,n)=swap
         enddo
         return
      endif
      iter=iter-2
      ytry=amotsa(p,y,psum,mp,np,ndim,pb,yb,funk,ihi,yhi,-1.0D0)
```



```
      if(ytry.le.ylo)then
         ytry=amotsa(p,y,psum,mp,np,ndim,pb,yb,funk,ihi,yhi,2.0D0)
      else if(ytry.ge.ynhi)then
         ysave=yhi
         ytry=amotsa(p,y,psum,mp,np,ndim,pb,yb,funk,ihi,yhi,0.5D0)
         if(ytry.ge.ysave)then
            do   i=1,ndim+1
                if(i.ne.ilo)then
                   do   j=1,ndim
                       psum(j)=0.5d0*(p(i,j)+p(ilo,j))
                       p(i,j)=psum(j)
                   enddo
                   y(i)=funk(psum)
                endif
            enddo
            iter=iter-ndim
            goto 1
         endif
      else
         iter=iter+1
      endif
      goto 2
      END
```

```
      DOUBLE PRECISION FUNCTION amotsa(p,y,psum,mp,np,ndim,pb,yb,funk
     #  ,ihi,yhi,fac)
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      INTEGER ihi,mp,ndim,np,NMAX
      DOUBLE PRECISION fac,yb,yhi,p(mp,np),pb(np),psum(np),y(mp),funk
      PARAMETER (NMAX=200)
      EXTERNAL funk
      INTEGER idum,j
      DOUBLE PRECISION fac1,fac2,tt,yflu,ytry,ptry(NMAX),ran1
      COMMON/ambsa/tt,idum
      fac1=(1.d0-fac)/ndim
      fac2=fac1-fac
      do   j=1,ndim
          ptry(j)=psum(j)*fac1-p(ihi,j)*fac2
      enddo
      ytry=funk(ptry)
      if(ytry.le.yb)then
         do   j=1,ndim
             pb(j)=ptry(j)
         enddo
         yb=ytry
      endif
      yflu=ytry-tt*log(ran1(idum))
      if(yflu.lt.yhi)then
         y(ihi)=ytry
         yhi=yflu
         do   j=1,ndim
             psum(j)=psum(j)-p(ihi,j)+ptry(j)
             p(ihi,j)=ptry(j)
         enddo
      endif
      amotsa=yflu
      return
      END
```

```fortran
      SUBROUTINE tqli(d,e,n,np,z)
      IMPLICIT DOUBLE PRECISION (a-h,o-z)
      DOUBLE PRECISION  d(np),e(np),z(np,np)
C     INTEGER n,np
C     INTEGER i,iter,l,m,k
C     DOUBLE PRECISION b,c,dd,f,g,p,r,s,pythag
      do   i=2,n
          e(i-1)=e(i)
      enddo
      e(n)=0.d0
      do   l=1,n
          iter=0
  1       do   m=l,n-1
              dd=dabs(d(m))+dabs(d(m+1))
              if(dabs(e(m))+dd.eq.dd)goto 2
          enddo
          m=n
  2       if(m.ne.l)then
             if(iter.eq.30)pause 'too many iterations in tqli'
             iter=iter+1
             g=(d(l+1)-d(l))/(2.d0*e(l))
             r=pythag(g,1.d0)
             g=d(m)-d(l)+e(l)/(g+sign(r,g))
             s=1.d0
             c=1.d0
             p=0.d0
             do   i=m-1,l,-1
                 f=s*e(i)
                 b=c*e(i)
                 r=pythag(f,g)
                 e(i+1)=r
                 if(r.eq.0.d0)then
                    d(i+1)=d(i+1)-p
                    e(m)=0.d0
                    goto 1
                 endif
                 s=f/r
                 c=g/r
                 g=d(i+1)-p
                 r=(d(i)-g)*s+2.d0*c*b
                 p=s*r
                 d(i+1)=g+p
                 g=c*r-b
C ********************************************
C                do   k=1,n
C                    f=z(k,i+1)
C                    z(k,i+1)=s*z(k,i)+c*f
C                    z(k,i)=c*z(k,i)-s*f
C                enddo
C ********************************************
             enddo
             d(l)=d(l)-p
             e(l)=g
             e(m)=0.d0
             goto 1
          endif
      enddo
      return
      END
```

```
      SUBROUTINE tred2(a,n,np,d,e)
      IMPLICIT DOUBLE PRECISION (a-h,o-z)
      DOUBLE PRECISION a(np,np),d(np),e(np)
C     INTEGER n,np
C     INTEGER i,j,k,l
C     DOUBLE PRECISION f,g,h,hh,scale
      do  i=n,2,-1
         l=i-1
         h=0.d0
         scale=0.d0
         if(l.gt.1)then
            do   k=1,l
                scale=scale+dabs(a(i,k))
            enddo
            if(scale.eq.0.d0)then
               e(i)=a(i,l)
            else
               do   k=1,l
                   a(i,k)=a(i,k)/scale
                   h=h+a(i,k)**2
               enddo
               f=a(i,l)
               g=-sign(dsqrt(h),f)
               e(i)=scale*g
               h=h-f*g
               a(i,l)=f-g
               f=0.d0
               do   j=1,l
C                  a(j,i)=a(i,j)/h
                   g=0.d0
                   do  k=1,j
                      g=g+a(j,k)*a(i,k)
                   enddo
                   do  k=j+1,l
                      g=g+a(k,j)*a(i,k)
                   enddo
                   e(j)=g/h
                   f=f+e(j)*a(i,j)
               enddo
               hh=f/(h+h)
               do   j=1,l
                   f=a(i,j)
                   g=e(j)-hh*f
                   e(j)=g
                   do   k=1,j
                       a(j,k)=a(j,k)-f*e(k)-g*a(i,k)
                   enddo
               enddo
            endif
         else
            e(i)=a(i,l)
         endif
         d(i)=h
      enddo
C     d(1)=0.d0
      e(1)=0.d0
      do   i=1,n
C ********************************************
C         l=i-1
C         if(d(i).ne.0.d0)then
C            do   j=1,l
C                g=0.d0
```



```
C                do   k=1,l
C                    g=g+a(i,k)*a(k,j)
C                enddo
C                do   k=1,l
C                    a(k,j)=a(k,j)-g*a(k,i)
C                enddo
C            enddo
C         endif
C ********************************************
          d(i)=a(i,i)
C ********************************************
C         a(i,i)=1.d0
C         do   j=1,l
C             a(i,j)=0.d0
C             a(j,i)=0.d0
C         enddo
C ********************************************
      enddo
      return
      END
```

```
      DOUBLE PRECISION FUNCTION ran1(idum)
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      INTEGER idum,IA,IM,IQ,IR,NTAB,NDIV
      DOUBLE PRECISION AM,EPS,RNMX
      PARAMETER (IA=16807,IM=2147483647,AM=1.d0/IM,IQ=127773,IR=2836,
     # NTAB=32,NDIV=1+(IM-1)/NTAB,EPS=2.2d-16,RNMX=1.d0-EPS)
      INTEGER j,k,iv(NTAB),iy
      SAVE iv,iy
      DATA iv /NTAB*0/, iy /0/
      if(idum.le.0.or.iy.eq.0)then
         idum=max(-idum,1)
         do   j=NTAB+8,1,-1
             k=idum/IQ
             idum=IA*(idum-k*IQ)-IR*k
             if(idum.lt.0)idum=idum+IM
             if(j.le.NTAB) iv(j)=idum
         enddo
      iy=iv(1)
      endif
      k=idum/IQ
      idum=IA*(idum-k*IQ)-IR*k
      if(idum.lt.0)idum=idum+IM
      j=1+iy/NDIV
      iy=iv(j)
      iv(j)=idum
      ran1=min(AM*iy,RNMX)
      return
      END
```