VI. U Z U P E Ł N I E N I E

dotyczące programów obliczeń
związanych z rozprawą doktorską pt.:
"Kinetyka rekombinacji atomowego
wodoru na filmach metali przejściowych"

A. Jabłoński

Uzupełnienie to zostało opracowane ze względu na stosowanie metody Smitha - Linnetta w Zakładzie Katalizy na Metalach IChF PAN. Przeznaczone jest ono dla przyszłych użytkowników tej metody. Załączono programy służące do analizy danych doświadczalnych związanych z kinetyką rekombinacji atomowego wodoru. Podano również sposób przygotowania danych do obliczeń oraz sposób uruchamiania programów. Napisane są one w języku Algol 1204; umożliwiają dokonywanie obliczeń na maszynie cyfrowej Odra 1204.

## VI. 1. Program analizy danych doświadczalnych metodą Smitha - Linnetta

A. Algorytm.

Jest on szczegółowo opisany w punkcie 8.4.1. rozprawy.

B. Postać danych.

Należy je wprowadzać w następującej kolejności:

k - numer eksperymentu;

n - liczba pomiarów aktywności badanej powierzchni;

eps - parametr $\varepsilon/k$ potencjału Lennarda - Jonesa (6-12) dla oddziaływania $H - H_2$ [$^oK$];

sigma - parametr $\delta$ potencjału Lennarda - Jonesa (6-12) dla oddziaływania $H - H_2$ [Å];

R - promień wewnętrzny cylindrycznej wkładki [cm];

$m_i$ - tabela liczb punktów doświadczalnych w kolejnych pomiarach ($i = 1, 2, ..., n$);

$p_i$ - tabela ciśnień wodoru w czasie kolejnych pomiarów ($i = 1, 2,...,n$) [$10^{-3}$ Tr];

$temp_i$ - tabela kolejnych temperatur ($i = 1, 2,...,n$) [$^oC$];

$X_{ij}$ - tabela położeń ruchomej sondy katalitycznej dla kolej-

nych pomiarów. ( odległości spoiny pokrytej srebrem od dowolnie ustalonego punktu w bocznym ramieniu ;
$i = 1, 2,\ldots,n$ ; $j = 1, 2,\ldots, m_i$ ) [ cm ] ;

$E_{ij}$ - siły termoelektryczne termopary miedź - konstantan odpowiadające położeniom $X_{ij}$ ( $i = 1, 2,\ldots, n$; $j = 1, 2,\ldots, m_i$ ) [ $10^{-5}$ v ] ,

C. Uruchamianie programu.

Po starcie na monitorze pojawi się napis "wait dane". Należy wówczas wczytać zestaw danych po naciśnięciu dowolnego klawisza na monitorze. Sygnałem końca obliczeń jest powtórne pojawienie się napisu "wait dane".

```
begin
   integer k, n, i, j, v;
   real eps, sigma, R, p1, p2, a, b, c, d, alfa, T, Tr, const, omega,h, Eo, Et, xb, ga, gb;
ZZ:wait('dane');
   read(k, n, eps, sigma, R);
   begin
      integer array m[1:n];
      array p, temp[1:n];   read(m, p, temp);   v:=0;
      for i:=1 step 1 until n do v:=v+m[i];
      begin
         array X, E, delta[1:v],WW[1:4];
         real procedure F(x);
            value x;
            real x;
            begin
               real p;
               integer i;
               p:=0;
               for i:=1 step 1 until 4 do p:=p×x+WW[i];
               F:=p×x
            end F;
         WW[1]:= 1.48098339_10-11;
         WW[2]:=-3.60121584_10-8;
         WW[3]:= 4.62395134_10-5;
         WW[4]:= 3.85014117_10-2;
```

```
read(X,E);   h:=0.5;   v:=0;
for i:=1 step 1 until n do
   begin
      Eo:=F(temp[i]);
      for j:=1 step 1 until m[i] do
         begin
            xb:=0;
            Et:=Eo+E[v+j]/100;
            if Et=0 then go to ZD;
            if Et<0 then h:=-abs(h) else h:=abs(h);
            if F(xb) -Et<0 then go to ZB;
         ZA:if F(xb) -Et>0 then
               begin
                  xb:=xb+h;   go to ZA
               end;
            ga:=xb;   gb:=xb-h;   go to ZC;
         ZB:if F(xb) -Et<0 then
               begin
                  xb:=xb+h;   go to ZB
               end;
            gb:=xb;   ga:=xb-h;
         ZC:xb:=(ga+gb)/2;
            if F(xb) -Et>0 then gb:=xb else ga:=xb;
            if abs(ga-gb)>1⏨-8 then go to ZC;
         ZD:delta[v+j]:=xb-temp[i]
```

```
                    end;
                 v:=v+m[i]
              end;
          line(1);
          print('Experiment␣no␣');    format('11');    print(k);
          line(2);
print('No␣␣␣␣␣␣␣␣␣␣␣␣T␣␣␣␣␣␣␣␣␣␣␣␣p␣␣␣␣␣␣␣␣␣␣␣␣␣gamma␣␣␣␣␣␣␣␣␣1000/T␣␣␣␣␣␣␣␣ln(gamma)
␣␣␣␣␣␣␣␣␣␣[deg␣K]␣␣␣␣␣␣␣[torr]␣␣␣␣Smith␣Linnett
␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣analysis');
format('?11␣␣␣␣␣␣␣␣␣111.1␣␣␣␣␣␣␣␣␣.111␣␣␣␣␣␣␣␣␣1.11⏨-1␣␣␣␣␣␣␣␣␣1.111␣␣␣␣␣␣␣␣-1.111⏨-1');
          line(1);    v:=0;
          for i:=1 step 1 until n do
             begin
                T:=temp[i] + 273;    Tr:=T/eps;
                omega:=1.075×exp(-0.1615×ln(Tr))+2×exp(-0.321377916 6×ln(10×Tr)×ln(10×Tr));
                a:=b:=c:=d:=0;
                for j:=1 step 1 until m[i] do
                   begin
                      a:=a+X[v+j];
                      b:=b+ln(delta[v+j]);
                      c:=c+X[v+j]×X[v+j];
                      d:=d+X[v+j]×ln(delta[v+j])
                   end;
                p1:=m[i]×d-a×b;    p2:=m[i]×c-a×a;    alfa:=p1/p2;
                const:=0.2378043918×R/(p[i]×sigma×sigma×omega);
```

```
          Tr:=const×T×alfa×alfa;   print(i,T,p[i]/1000,Tr,1000/T,ln(Tr));
          v:=v+m[i]
        end;
      line(15);
      go to ZZ
    end
  end
end?
```

VI. 2. Program analizy danych doświadczalnych w oparciu o równanie (6.6)

A. Algorytm.

Jest on szczegółowo opisany w punkcie 8.4.2 rozprawy.

B. Postać danych.

Należy je wprowadzać w następującej kolejności:

k – numer eksperymentu;

n – liczba pomiarów aktywności badanej powierzchni;

eps – parametr $\varepsilon/k$ potencjału Lennarda – Jonesa (6-12) dla oddziaływania $H - H_2$ [°K];

sigma – parametr $\delta$ potencjału Lennarda – Jonesa dla oddziaływania $H - H_2$ [Å];

R – wewnętrzny promień cylindrycznej wkładki [cm];

$m_i$ – tabela liczb punktów doświadczalnych w kolejnych pomiarach ($i = 1,2,\ldots,n$);

$p_i$ – tabela ciśnień wodoru w czasie kolejnych pomiarów ($i = 1,2,\ldots,n$); [$10^{-3}$ Tr];

$temp_i$ – tabela kolejnych temperatur ($i = 1,2,\ldots,n$) [°C];

$X_{ij}$ – tabela położeń ruchomej sondy katalitycznej dla kolejnych pomiarów ($i = 1,2,\ldots,n$ ; $j = 1,2,\ldots,m_i$) [cm]. Pomiarów siły termoelektrycznej dokonywano w następującej kolejności. Początkowo ustawiano spoinę termopary pokrytą srebrem na wysokości przedniej krawędzi cylindrycznej wkładki (w kierunku wyładowań). Położeniu temu odpowiadała największa wartość odległości X. Po zmierzeniu siły termoelektrycznej termoparę cofano maksymalnie do tyłu (najmniejsza wartość X). Następnie dokonywano kilku pomiarów siły termoelektrycznej przesuwając termoparę stopniowo do przodu, aż do położenia początkowego. W takiej kolejności należy podawać wartości $X_{ij}$ dla danego i, tj.

$$X_{i1} > X_{i2} < X_{i3} < \dots < X_{im_i} = X_{i1} .$$

$E_{ij}$ - siły termoelektryczne termopary miedź - konstantan odpowiadające położeniom $X_{ij}$ ( $i = 1,2,\dots,n$ ; $j = 1,2,\dots,m_i$) $[10^{-5}\ V]$.

Na stronie A9 podano przykładowe zestawienie danych do obliczeń. Dane te zebrano podczas eksperymentu nr 34 ( film Ni na pyreksie).

C. Uruchamianie programu.

Po starcie należy wczytać tabele wartości $\alpha_i(\delta)$ oraz $\beta_i(\delta)$ zestawione na stronach A10-A21 dla $i = 1,2,\dots, 30$ . Należy je wczytywać kolejno kolumnami. Wielkość $\alpha_i(\delta)$ oznacza i - ty pierwiastek równania $x\delta J_1(x) = J_0(x)$, gdzie $J_k(x)$ jest funkcją Bessela pierwszego rodzaju, k - tego rzędu; $\delta$ jest dyfuzyjną liczbą Reynoldsa. Wielkość $\beta_i(\delta)$ dana jest wzorem

$$\beta_i(\delta) = \frac{2}{\alpha_i(1 + \alpha_i^2\ \delta^2)J_1(\alpha_i)} .$$

Na monitorze pojawi się napis "wait dane". Należy wówczas wczytać zestaw danych po naciśnięciu dowolnego klawisza na monitorze. Sygnałem końca obliczeń jest pojawienie się na monitorze napisu "END".

D. Przykład przygotowania danych do obliczeń .
Eksperyment 34; Ni/pyreks

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| k | 34 | | | | | | | | | | | |
| n | 12 | | | | | | | | | | | |
| eps | 85 | | | | | | | | | | | |
| sigma | 2.32 | | | | | | | | | | | |
| R | 1.6 | | | | | | | | | | | |
| $m_i$ | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| $p_i$ | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| $T_i$ | 180 | 180 | 90 | 90 | 25 | 25 | -28 | -28 | -58 | -58 | 180 | 180 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $x_{ij}$ | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| | 10 | 3 | 5 | 7 | 9 | 10 |
| $E_{ij}$ | 91.7 | 12.8 | 19.9 | 35.8 | 66.9 | 89.5 |
| | 84.9 | 14.3 | 21.5 | 36.5 | 64.6 | 84.2 |
| | 84.2 | 13.1 | 21.8 | 37.9 | 65.3 | 82.3 |
| | 79.8 | 14.5 | 23.5 | 39.0 | 64.3 | 79.1 |
| | 89.2 | 19.7 | 31.6 | 50.3 | 78.0 | 93.9 |
| | 95.5 | 25.2 | 37.7 | 56.2 | 82.1 | 97.0 |
| | 324.6 | 271.9 | 289.7 | 305.3 | 319.4 | 325.8 |
| | 328.7 | 275.6 | 292.6 | 308.8 | 323.5 | 331.6 |
| | 316.4 | 270.4 | 287.9 | 302.6 | 315.6 | 322.3 |
| | 326.8 | 277.2 | 292.8 | 308.5 | 327.0 | 337.1 |
| | 76.1 | 16.8 | 23.1 | 36.9 | 60.6 | 75.4 |
| | 73.4 | 16.2 | 22.6 | 35.8 | 58.5 | 68.9 |

| delta | alfa i .125 | .250 | .500 | 1 | 2 |
|---|---|---|---|---|---|
| i | | | | | |
| 1 | 2.1286385 | 1.9080788 | 1.5994492 | 1.2557837 | .9407706 |
| 2 | 4.9383790 | 4.6018456 | 4.2909585 | 4.0794777 | 3.9593712 |
| 3 | 7.8463581 | 7.5200705 | 7.2883889 | 7.1557992 | 7.0863809 |
| 4 | 10.8270595 | 10.5422877 | 10.3658311 | 10.2709853 | 10.2224584 |
| 5 | 13.8566370 | 13.6124763 | 13.4718820 | 13.3983975 | 13.3611489 |
| 6 | 16.9178805 | 16.7072688 | 16.5910330 | 16.5311589 | 16.5009499 |
| 7 | 19.9998800 | 19.8160365 | 19.7172066 | 19.6667278 | 19.6413261 |
| 8 | 23.0958848 | 22.9334138 | 22.8475656 | 22.8039505 | 22.7820386 |
| 9 | 26.2016519 | 26.0564403 | 25.9806148 | 25.9422289 | 25.9229648 |
| 10 | 29.3144372 | 29.1833616 | 29.1154936 | 29.0812218 | 29.0640354 |
| 11 | 32.4324099 | 32.3130767 | 32.2516725 | 32.2207209 | 32.2052079 |
| 12 | 35.5543114 | 35.4448615 | 35.3888077 | 35.3605915 | 35.3464552 |
| 13 | 38.6792528 | 38.5782208 | 38.5266668 | 38.5007428 | 38.4877589 |
| 14 | 41.8065904 | 41.7128053 | 41.6650869 | 41.6411113 | 41.6291063 |
| 15 | 44.9358479 | 44.8483613 | 44.8039506 | 44.7816515 | 44.7704881 |
| 16 | 48.0666661 | 47.9847006 | 47.9431710 | 47.9223296 | 47.9118976 |
| 17 | 51.1987691 | 51.1216805 | 51.0826825 | 51.0631201 | 51.0533296 |
| 18 | 54.3319421 | 54.2591907 | 54.2224347 | 54.2040036 | 54.1947802 |
| 19 | 57.4660150 | 57.3971451 | 57.3623881 | 57.3449647 | 57.3362465 |
| 20 | 60.6008520 | 60.5354749 | 60.5025114 | 60.4859914 | 60.4777258 |
| 21 | 63.7363428 | 63.6741251 | 63.6427796 | 63.6270740 | 63.6192164 |
| 22 | 66.8723975 | 66.8130507 | 66.7831723 | 66.7682046 | 66.7607165 |
| 23 | 70.0089417 | 69.9522149 | 69.9236726 | 69.9093766 | 69.9022250 |
| 24 | 73.1459137 | 73.0915871 | 73.0642668 | 73.0505849 | 73.0437407 |
| 25 | 76.2832614 | 76.2311416 | 76.2049432 | 76.1918248 | 76.1852628 |
| 26 | 79.4209411 | 79.3708570 | 79.3456921 | 79.3330927 | 79.3267905 |
| 27 | 82.5589153 | 82.5107148 | 82.4865052 | 82.4743853 | 82.4683231 |
| 28 | 85.6971522 | 85.6506996 | 85.6273755 | 85.6156999 | 85.6098601 |
| 29 | 88.8356242 | 88.7907979 | 88.7682968 | 88.7570342 | 88.7514011 |
| 30 | 91.9743076 | 91.9309981 | 91.9092641 | 91.8983861 | 91.8929455 |

| delta i | alfa i 4 | 8 | 16 | 32 | 64 |
|---|---|---|---|---|---|
| 1 | .6855876 | .4922895 | .3508093 | .2490266 | .1764320 |
| 2 | 3.8963163 | 3.8641795 | 3.8479813 | 3.8398528 | 3.8357816 |
| 3 | 7.0511167 | 7.0333797 | 7.0244895 | 7.0200396 | 7.0178135 |
| 4 | 10.1980073 | 10.1857470 | 10.1796096 | 10.1765394 | 10.1750039 |
| 5 | 13.3424401 | 13.3330701 | 13.3283819 | 13.3260372 | 13.3248646 |
| 6 | 16.4858004 | 16.4782174 | 16.4744242 | 16.4725272 | 16.4715787 |
| 7 | 19.6285985 | 19.6222298 | 19.6190444 | 19.6174516 | 19.6166551 |
| 8 | 22.7710655 | 22.7655758 | 22.7628303 | 22.7614574 | 22.7607709 |
| 9 | 25.9133212 | 25.9084972 | 25.9060848 | 25.9048785 | 25.9042753 |
| 10 | 29.0554339 | 29.0511316 | 29.0489802 | 29.0479044 | 29.0473665 |
| 11 | 32.1974453 | 32.1935629 | 32.1916215 | 32.1906508 | 32.1901654 |
| 12 | 35.3393825 | 35.3358453 | 35.3340765 | 35.3331921 | 35.3327498 |
| 13 | 38.4812634 | 38.4780150 | 38.4763907 | 38.4755785 | 38.4751724 |
| 14 | 41.6231009 | 41.6200978 | 41.6185961 | 41.6178452 | 41.6174697 |
| 15 | 44.7649041 | 44.7621117 | 44.7607154 | 44.7600173 | 44.7596682 |
| 16 | 47.9066797 | 47.9040704 | 47.9027657 | 47.9021133 | 47.9017872 |
| 17 | 51.0484328 | 51.0459841 | 51.0447597 | 51.0441475 | 51.0438414 |
| 18 | 54.1901673 | 54.1878606 | 54.1867072 | 54.1861304 | 54.1858421 |
| 19 | 57.3318862 | 57.3297059 | 57.3286157 | 57.3280706 | 57.3277981 |
| 20 | 60.4735921 | 60.4715251 | 60.4704915 | 60.4699747 | 60.4697163 |
| 21 | 63.6152868 | 63.6133218 | 63.6123393 | 63.6118481 | 63.6116024 |
| 22 | 66.7569718 | 66.7550994 | 66.7541631 | 66.7536950 | 66.7534609 |
| 23 | 69.8986486 | 69.8968603 | 69.8959661 | 69.8955190 | 69.8952955 |
| 24 | 73.0403181 | 73.0386068 | 73.0377510 | 73.0373232 | 73.0371092 |
| 25 | 76.1819814 | 76.1803405 | 76.1795201 | 76.1791099 | 76.1789048 |
| 26 | 79.3236390 | 79.3220631 | 79.3212752 | 79.3208812 | 79.3206842 |
| 27 | 82.4652916 | 82.4637758 | 82.4630179 | 82.4626390 | 82.4624495 |
| 28 | 85.6069399 | 85.6054797 | 85.6047496 | 85.6043846 | 85.6042021 |
| 29 | 88.7485842 | 88.7471757 | 88.7464715 | 88.7461194 | 88.7459433 |
| 30 | 91.8902250 | 91.8888647 | 91.8881845 | 91.8878444 | 91.8876744 |

alfa i

| delta i | 128 | 256 | 512 | 1024 | 2048 |
|---|---|---|---|---|---|
| 1 | .1248780 | .0883452 | .0624847 | .0441888 | .0312481 |
| 2 | 3.8337443 | 3.8327253 | 3.8322157 | 3.8319608 | 3.8318334 |
| 3 | 7.0167002 | 7.0161434 | 7.0158651 | 7.0157259 | 7.0156563 |
| 4 | 10.1742360 | 10.1738521 | 10.1736601 | 10.1735641 | 10.1735161 |
| 5 | 13.3242783 | 13.3239851 | 13.3238385 | 13.3237652 | 13.3237286 |
| 6 | 16.4711044 | 16.4708672 | 16.4707486 | 16.4706893 | 16.4706597 |
| 7 | 19.6162568 | 19.6160577 | 19.6159581 | 19.6159083 | 19.6158834 |
| 8 | 22.7604276 | 22.7602560 | 22.7601702 | 22.7601273 | 22.7601059 |
| 9 | 25.9039737 | 25.9038229 | 25.9037475 | 25.9037098 | 25.9036910 |
| 10 | 29.0470975 | 29.0469631 | 29.0468958 | 29.0468622 | 29.0468454 |
| 11 | 32.1899227 | 32.1898013 | 32.1897407 | 32.1897103 | 32.1896951 |
| 12 | 35.3325287 | 35.3324182 | 35.3323629 | 35.3323353 | 35.3323214 |
| 13 | 38.4749694 | 38.4748678 | 38.4748171 | 38.4747917 | 38.4747790 |
| 14 | 41.6172820 | 41.6171882 | 41.6171412 | 41.6171178 | 41.6171060 |
| 15 | 44.7594936 | 44.7594064 | 44.7593627 | 44.7593409 | 44.7593300 |
| 16 | 47.9016241 | 47.9015425 | 47.9015018 | 47.9014814 | 47.9014712 |
| 17 | 51.0436883 | 51.0436118 | 51.0435735 | 51.0435544 | 51.0435448 |
| 18 | 54.1856979 | 54.1856258 | 54.1855898 | 54.1855718 | 54.1855628 |
| 19 | 57.3276618 | 57.3275937 | 57.3275596 | 57.3275426 | 57.3275340 |
| 20 | 60.4695871 | 60.4695225 | 60.4694902 | 60.4694741 | 60.4694660 |
| 21 | 63.6114796 | 63.6114182 | 63.6113875 | 63.6113721 | 63.6113645 |
| 22 | 66.7533438 | 66.7532853 | 66.7532561 | 66.7532415 | 66.7532341 |
| 23 | 69.8951837 | 69.8951278 | 69.8950999 | 69.8950859 | 69.8950789 |
| 24 | 73.0370023 | 73.0369488 | 73.0369221 | 73.0369087 | 73.0369020 |
| 25 | 76.1788022 | 76.1787509 | 76.1787253 | 76.1787125 | 76.1787061 |
| 26 | 79.3205857 | 79.3205365 | 79.3205119 | 79.3204996 | 79.3204934 |
| 27 | 82.4623547 | 82.4623074 | 82.4622837 | 82.4622718 | 82.4622659 |
| 28 | 85.6041108 | 85.6040651 | 85.6040423 | 85.6040309 | 85.6040252 |
| 29 | 88.7458553 | 88.7458112 | 88.7457892 | 88.7457782 | 88.7457727 |
| 30 | 91.8875893 | 91.8875468 | 91.8875256 | 91.8875150 | 91.8875096 |

| | alfa i | | | | |
|---|---|---|---|---|---|
| delta i | 4096 | 8192 | 16384 | 32768 | 65536 |
| 1 | .0220964 | .0156248 | .0110485 | .0078125 | .0055243 |
| 2 | 3.8317697 | 3.8317378 | 3.8317219 | 3.8317140 | 3.8317100 |
| 3 | 7.0156215 | 7.0156041 | 7.0155954 | 7.0155910 | 7.0155889 |
| 4 | 10.1734921 | 10.1734801 | 10.1734741 | 10.1734711 | 10.1734696 |
| 5 | 13.3237102 | 13.3237011 | 13.3236965 | 13.3236942 | 13.3236931 |
| 6 | 16.4706449 | 16.4706375 | 16.4706337 | 16.4706319 | 16.4706310 |
| 7 | 19.6158710 | 19.6158648 | 19.6158616 | 19.6158601 | 19.6158593 |
| 8 | 22.7600951 | 22.7600898 | 22.7600871 | 22.7600857 | 22.7600851 |
| 9 | 25.9036815 | 25.9036768 | 25.9036745 | 25.9036733 | 25.9036727 |
| 10 | 29.0468370 | 29.0468328 | 29.0468307 | 29.0468296 | 29.0468291 |
| 11 | 32.1896876 | 32.1896838 | 32.1896819 | 32.1896809 | 32.1896805 |
| 12 | 35.3323145 | 35.3323111 | 35.3323094 | 35.3323085 | 35.3323081 |
| 13 | 38.4747727 | 38.4747695 | 38.4747679 | 38.4747671 | 38.4747667 |
| 14 | 41.6171002 | 41.6170972 | 41.6170958 | 41.6170950 | 41.6170947 |
| 15 | 44.7593245 | 44.7593218 | 44.7593204 | 44.7593198 | 44.7593194 |
| 16 | 47.9014661 | 47.9014635 | 47.9014622 | 47.9014616 | 47.9014613 |
| 17 | 51.0435401 | 51.0435377 | 51.0435365 | 51.0435359 | 51.0435356 |
| 18 | 54.1855582 | 54.1855560 | 54.1855549 | 54.1855543 | 54.1855540 |
| 19 | 57.3275298 | 57.3275277 | 57.3275266 | 57.3275261 | 57.3275258 |
| 20 | 60.4694620 | 60.4694600 | 60.4694589 | 60.4694584 | 60.4694582 |
| 21 | 63.6113606 | 63.6113587 | 63.6113577 | 63.6113573 | 63.6113570 |
| 22 | 66.7532305 | 66.7532287 | 66.7532277 | 66.7532273 | 66.7532270 |
| 23 | 69.8950754 | 69.8950737 | 69.8950728 | 69.8950724 | 69.8950721 |
| 24 | 73.0368987 | 73.0368970 | 73.0368961 | 73.0368957 | 73.0368955 |
| 25 | 76.1787029 | 76.1787013 | 76.1787005 | 76.1787001 | 76.1786999 |
| 26 | 79.3204903 | 79.3204888 | 79.3204880 | 79.3204876 | 79.3204875 |
| 27 | 82.4622630 | 82.4622615 | 82.4622607 | 82.4622604 | 82.4622602 |
| 28 | 85.6040224 | 85.6040209 | 85.6040202 | 85.6040199 | 85.6040197 |
| 29 | 88.7457700 | 88.7457686 | 88.7457679 | 88.7457676 | 88.7457674 |
| 30 | 91.8875070 | 91.8875056 | 91.8875050 | 91.8875047 | 91.8875045 |

| | alfa i | | | | |
|---|---|---|---|---|---|
| delta | 131072 | 262144 | 524288 | 1048576 | 2097152 |
| i | | | | | |
| 1 | .0039062 | .0027621 | .0019531 | .0013811 | .0009766 |
| 2 | 3.8317080 | 3.8317070 | 3.8317065 | 3.8317062 | 3.8317061 |
| 3 | 7.0155878 | 7.0155872 | 7.0155869 | 7.0155868 | 7.0155868 |
| 4 | 10.1734689 | 10.1734685 | 10.1734683 | 10.1734682 | 10.1734682 |
| 5 | 13.3236925 | 13.3236922 | 13.3236921 | 13.3236920 | 13.3236920 |
| 6 | 16.4706305 | 16.4706303 | 16.4706301 | 16.4706301 | 16.4706301 |
| 7 | 19.6158589 | 19.6158587 | 19.6158586 | 19.6158586 | 19.6158585 |
| 8 | 22.7600847 | 22.7600846 | 22.7600845 | 22.7600844 | 22.7600844 |
| 9 | 25.9036724 | 25.9036723 | 25.9036722 | 25.9036722 | 25.9036721 |
| 10 | 29.0468288 | 29.0468287 | 29.0468287 | 29.0468286 | 29.0468286 |
| 11 | 32.1896802 | 32.1896801 | 32.1896800 | 32.1896800 | 32.1896800 |
| 12 | 35.3323078 | 35.3323077 | 35.3323077 | 35.3323077 | 35.3323076 |
| 13 | 38.4747665 | 38.4747664 | 38.4747664 | 38.4747663 | 38.4747663 |
| 14 | 41.6170945 | 41.6170944 | 41.6170943 | 41.6170943 | 41.6170943 |
| 15 | 44.7593193 | 44.7593192 | 44.7593191 | 44.7593191 | 44.7593191 |
| 16 | 47.9014611 | 47.9014611 | 47.9014610 | 47.9014610 | 47.9014610 |
| 17 | 51.0435354 | 51.0435353 | 51.0435353 | 51.0435353 | 51.0435353 |
| 18 | 54.1855539 | 54.1855538 | 54.1855538 | 54.1855537 | 54.1855537 |
| 19 | 57.3275256 | 57.3275256 | 57.3275256 | 57.3275255 | 57.3275255 |
| 20 | 60.4694581 | 60.4694580 | 60.4694580 | 60.4694580 | 60.4694579 |
| 21 | 63.6113569 | 63.6113569 | 63.6113568 | 63.6113568 | 63.6113568 |
| 22 | 66.7532269 | 66.7532269 | 66.7532268 | 66.7532268 | 66.7532268 |
| 23 | 69.8950720 | 69.8950720 | 69.8950720 | 69.8950719 | 69.8950719 |
| 24 | 73.0368954 | 73.0368954 | 73.0368953 | 73.0368953 | 73.0368953 |
| 25 | 76.1786998 | 76.1786997 | 76.1786997 | 76.1786997 | 76.1786997 |
| 26 | 79.3204873 | 79.3204873 | 79.3204873 | 79.3204873 | 79.3204873 |
| 27 | 82.4622601 | 82.4622600 | 82.4622600 | 82.4622600 | 82.4622600 |
| 28 | 85.6040196 | 85.6040195 | 85.6040195 | 85.6040195 | 85.6040195 |
| 29 | 88.7457673 | 88.7457673 | 88.7457672 | 88.7457672 | 88.7457672 |
| 30 | 91.8875044 | 91.8875044 | 91.8875043 | 91.8875043 | 91.8875043 |

alfa i

| delta i | 4194304 | 8388608 | 16777216 | 33554432 | 67108864 |
|---|---|---|---|---|---|
| 1 | .0006905 | .0004883 | .0003453 | .0002441 | .0001726 |
| 2 | 3.8317060 | 3.8317060 | 3.8317060 | 3.8317060 | 3.8317060 |
| 3 | 7.0155867 | 7.0155867 | 7.0155867 | 7.0155867 | 7.0155867 |
| 4 | 10.1734681 | 10.1734681 | 10.1734681 | 10.1734681 | 10.1734681 |
| 5 | 13.3236919 | 13.3236919 | 13.3236919 | 13.3236919 | 13.3236919 |
| 6 | 16.4706300 | 16.4706300 | 16.4706300 | 16.4706300 | 16.4706300 |
| 7 | 19.6158585 | 19.6158585 | 19.6158585 | 19.6158585 | 19.6158585 |
| 8 | 22.7600844 | 22.7600844 | 22.7600844 | 22.7600844 | 22.7600844 |
| 9 | 25.9036721 | 25.9036721 | 25.9036721 | 25.9036721 | 25.9036721 |
| 10 | 29.0468286 | 29.0468286 | 29.0468286 | 29.0468286 | 29.0468286 |
| 11 | 32.1896800 | 32.1896800 | 32.1896800 | 32.1896800 | 32.1896800 |
| 12 | 35.3323076 | 35.3323076 | 35.3323076 | 35.3323076 | 35.3323076 |
| 13 | 38.4747663 | 38.4747663 | 38.4747663 | 38.4747663 | 38.4747663 |
| 14 | 41.6170943 | 41.6170943 | 41.6170943 | 41.6170943 | 41.6170943 |
| 15 | 44.7593191 | 44.7593191 | 44.7593191 | 44.7593191 | 44.7593191 |
| 16 | 47.9014610 | 47.9014610 | 47.9014610 | 47.9014610 | 47.9014610 |
| 17 | 51.0435353 | 51.0435353 | 51.0435353 | 51.0435353 | 51.0435353 |
| 18 | 54.1855537 | 54.1855537 | 54.1855537 | 54.1855537 | 54.1855537 |
| 19 | 57.3275255 | 57.3275255 | 57.3275255 | 57.3275255 | 57.3275255 |
| 20 | 60.4694579 | 60.4694579 | 60.4694579 | 60.4694579 | 60.4694579 |
| 21 | 63.6113568 | 63.6113568 | 63.6113568 | 63.6113568 | 63.6113568 |
| 22 | 66.7532268 | 66.7532268 | 66.7532268 | 66.7532268 | 66.7532268 |
| 23 | 69.8950719 | 69.8950719 | 69.8950719 | 69.8950719 | 69.8950719 |
| 24 | 73.0368953 | 73.0368953 | 73.0368953 | 73.0368953 | 73.0368953 |
| 25 | 76.1786997 | 76.1786997 | 76.1786997 | 76.1786997 | 76.1786997 |
| 26 | 79.3204873 | 79.3204873 | 79.3204873 | 79.3204873 | 79.3204873 |
| 27 | 82.4622600 | 82.4622600 | 82.4622600 | 82.4622600 | 82.4622600 |
| 28 | 85.6040195 | 85.6040195 | 85.6040195 | 85.6040195 | 85.6040195 |
| 29 | 88.7457672 | 88.7457672 | 88.7457672 | 88.7457672 | 88.7457672 |
| 30 | 91.8875043 | 91.8875043 | 91.8875043 | 91.8875043 | 91.8875043 |

| | beta i | | | | |
|---|---|---|---|---|---|
| delta | .125 | .250 | .500 | 1 | 2 |
| i | | | | | |
| 1 | 1.5525781 | 1.4697956 | 1.3383772 | 1.2070921 | 1.1142546 |
| 2 | -.9162988 | -.7278092 | -.4922691 | -.2901494 | -.1571596 |
| 3 | .6189424 | .4183493 | .2421773 | .1289081 | .0661898 |
| 4 | -.4430213 | -.2699274 | -.1464150 | -.0755689 | -.0382776 |
| 5 | .3316160 | .1898056 | .0998464 | .0508804 | .0256352 |
| 6 | -.2576606 | -.1419066 | -.0734361 | -.0371831 | -.0186852 |
| 7 | .2064453 | .1109217 | .0568498 | .0286801 | .0143910 |
| 8 | -.1696211 | -.0896358 | -.0456594 | -.0229825 | -.0115216 |
| 9 | .1422699 | .0743162 | .0377001 | .0189476 | .0094932 |
| 10 | -.1213828 | -.0628776 | -.0318051 | -.0159681 | -.0079970 |
| 11 | .1050498 | .0540799 | .0272973 | .0136945 | .0068563 |
| 12 | -.0920165 | -.0471468 | -.0237601 | -.0119132 | -.0059632 |
| 13 | .0814334 | .0415710 | .0209246 | .0104869 | .0052483 |
| 14 | -.0727089 | -.0370092 | -.0186105 | -.0093240 | -.0046657 |
| 15 | .0654212 | .0332216 | .0166931 | .0083611 | .0041834 |
| 16 | -.0592628 | -.0300367 | -.0150834 | -.0075532 | -.0037788 |
| 17 | .0540051 | .0273286 | .0137165 | .0068674 | .0034355 |
| 18 | -.0494754 | -.0250033 | -.0125440 | -.0062795 | -.0031412 |
| 19 | .0455410 | .0229892 | .0115294 | .0057708 | .0028866 |
| 20 | -.0420985 | -.0212312 | -.0106445 | -.0053274 | -.0026647 |
| 21 | .0390664 | .0196860 | .0098672 | .0049379 | .0024698 |
| 22 | -.0363797 | -.0183191 | -.0091801 | -.0045936 | -.0022975 |
| 23 | .0339859 | .0171032 | .0085691 | .0042876 | .0021444 |
| 24 | -.0318425 | -.0160159 | -.0080229 | -.0040141 | -.0020076 |
| 25 | .0299143 | .0150390 | .0075324 | .0037685 | .0018847 |
| 26 | -.0281725 | -.0141574 | -.0070899 | -.0035469 | -.0017739 |
| 27 | .0265928 | .0133585 | .0066891 | .0033463 | .0016735 |
| 28 | -.0251549 | -.0126320 | -.0063246 | -.0031638 | -.0015822 |
| 29 | .0238417 | .0119690 | .0059921 | .0029974 | .0014989 |
| 30 | -.0226386 | -.0113620 | -.0056877 | -.0028450 | -.0014227 |

| | beta i | | | | |
|---|---|---|---|---|---|
| delta i | 4 | 8 | 16 | 32 | 64 |
| 1 | 1.0598419 | 1.0305914 | 1.0154612 | 1.0077717 | 1.0038960 |
| 2 | -.0816082 | -.0415484 | -.0209576 | -.0105242 | -.0052734 |
| 3 | .0334883 | .0168366 | .0084406 | .0042258 | .0021142 |
| 4 | -.0192478 | -.0096493 | -.0048307 | -.0024169 | -.0012088 |
| 5 | .0128603 | .0064400 | .0032224 | .0016118 | .0008060 |
| 6 | -.0093630 | -.0046862 | -.0023442 | -.0011724 | -.0005863 |
| 7 | .0072066 | .0036059 | .0018035 | .0009019 | .0004510 |
| 8 | -.0057674 | -.0028852 | -.0014430 | -.0007216 | -.0003608 |
| 9 | .0047508 | .0023764 | .0011884 | .0005943 | .0002971 |
| 10 | -.0040013 | -.0020013 | -.0010008 | -.0005004 | -.0002502 |
| 11 | .0034301 | .0017155 | .0008579 | .0004290 | .0002145 |
| 12 | -.0029830 | -.0014918 | -.0007460 | -.0003730 | -.0001865 |
| 13 | .0026252 | .0013129 | .0006565 | .0003283 | .0001641 |
| 14 | -.0023337 | -.0011670 | -.0005836 | -.0002918 | -.0001459 |
| 15 | .0020923 | .0010463 | .0005232 | .0002616 | .0001308 |
| 16 | -.0018899 | -.0009451 | -.0004726 | -.0002363 | -.0001181 |
| 17 | .0017182 | .0008592 | .0004296 | .0002148 | .0001074 |
| 18 | -.0015709 | -.0007855 | -.0003928 | -.0001964 | -.0000982 |
| 19 | .0014436 | .0007218 | .0003609 | .0001805 | .0000902 |
| 20 | -.0013326 | -.0006663 | -.0003332 | -.0001666 | -.0000833 |
| 21 | .0012351 | .0006176 | .0003088 | .0001544 | .0000772 |
| 22 | -.0011489 | -.0005745 | -.0002873 | -.0001436 | -.0000718 |
| 23 | .0010723 | .0005362 | .0002681 | .0001341 | .0000670 |
| 24 | -.0010039 | -.0005020 | -.0002510 | -.0001255 | -.0000627 |
| 25 | .0009424 | .0004712 | .0002356 | .0001178 | .0000589 |
| 26 | -.0008870 | -.0004435 | -.0002218 | -.0001109 | -.0000554 |
| 27 | .0008368 | .0004184 | .0002092 | .0001046 | .0000523 |
| 28 | -.0007912 | -.0003956 | -.0001978 | -.0000989 | -.0000494 |
| 29 | .0007495 | .0003748 | .0001874 | .0000937 | .0000468 |
| 30 | -.0007114 | -.0003557 | -.0001779 | -.0000889 | -.0000445 |

beta i

| delta i | 128 | 256 | 512 | 1024 | 2048 |
|---|---|---|---|---|---|
| 1 | 1.0019507 | 1.0009759 | 1.0004878 | 1.0002445 | 1.0001211 |
| 2 | -.0026395 | -.0013205 | -.0006604 | -.0003303 | -.0001651 |
| 3 | .0010575 | .0005288 | .0002644 | .0001322 | .0000661 |
| 4 | -.0006045 | -.0003023 | -.0001511 | -.0000756 | -.0000378 |
| 5 | .0004031 | .0002015 | .0001008 | .0000504 | .0000252 |
| 6 | -.0002931 | -.0001466 | -.0000733 | -.0000366 | -.0000183 |
| 7 | .0002255 | .0001128 | .0000564 | .0000282 | .0000141 |
| 8 | -.0001804 | -.0000902 | -.0000451 | -.0000225 | -.0000113 |
| 9 | .0001486 | .0000743 | .0000371 | .0000186 | .0000093 |
| 10 | -.0001251 | -.0000626 | -.0000313 | -.0000156 | -.0000078 |
| 11 | .0001072 | .0000536 | .0000268 | .0000134 | .0000067 |
| 12 | -.0000933 | -.0000466 | -.0000233 | -.0000117 | -.0000058 |
| 13 | .0000821 | .0000410 | .0000205 | .0000103 | .0000051 |
| 14 | -.0000729 | -.0000365 | -.0000182 | -.0000091 | -.0000046 |
| 15 | .0000654 | .0000327 | .0000163 | .0000082 | .0000041 |
| 16 | -.0000591 | -.0000295 | -.0000148 | -.0000074 | -.0000037 |
| 17 | .0000537 | .0000268 | .0000134 | .0000067 | .0000034 |
| 18 | -.0000491 | -.0000245 | -.0000123 | -.0000061 | -.0000031 |
| 19 | .0000451 | .0000226 | .0000113 | .0000056 | .0000028 |
| 20 | -.0000416 | -.0000208 | -.0000104 | -.0000052 | -.0000026 |
| 21 | .0000386 | .0000193 | .0000097 | .0000048 | .0000024 |
| 22 | -.0000359 | -.0000180 | -.0000090 | -.0000045 | -.0000022 |
| 23 | .0000335 | .0000168 | .0000084 | .0000042 | .0000021 |
| 24 | -.0000314 | -.0000157 | -.0000078 | -.0000039 | -.0000020 |
| 25 | .0000295 | .0000147 | .0000074 | .0000037 | .0000018 |
| 26 | -.0000277 | -.0000139 | -.0000069 | -.0000035 | -.0000017 |
| 27 | .0000262 | .0000131 | .0000065 | .0000033 | .0000016 |
| 28 | -.0000247 | -.0000124 | -.0000062 | -.0000031 | -.0000015 |
| 29 | .0000234 | .0000117 | .0000059 | .0000029 | .0000015 |
| 30 | -.0000222 | -.0000111 | -.0000056 | -.0000028 | -.0000014 |

beta i

| delta | 4096 | 8192 | 16384 | 32768 | 65536 |
|---|---|---|---|---|---|
| i | | | | | |
| 1 | 1.0000601 | 1.0000286 | 1.0000155 | 1.0000038 | 1.0000081 |
| 2 | -.0000826 | -.0000413 | -.0000206 | -.0000103 | -.0000052 |
| 3 | .0000331 | .0000165 | .0000083 | .0000041 | .0000021 |
| 4 | -.0000189 | -.0000094 | -.0000047 | -.0000024 | -.0000012 |
| 5 | .0000126 | .0000063 | .0000031 | .0000016 | .0000008 |
| 6 | -.0000092 | -.0000046 | -.0000023 | -.0000011 | -.0000006 |
| 7 | .0000071 | .0000035 | .0000018 | .0000009 | .0000004 |
| 8 | -.0000056 | -.0000028 | -.0000014 | -.0000007 | -.0000004 |
| 9 | .0000046 | .0000023 | .0000012 | .0000006 | .0000003 |
| 10 | -.0000039 | -.0000020 | -.0000010 | -.0000005 | -.0000002 |
| 11 | .0000034 | .0000017 | .0000008 | .0000004 | .0000002 |
| 12 | -.0000029 | -.0000015 | -.0000007 | -.0000004 | -.0000002 |
| 13 | .0000026 | .0000013 | .0000006 | .0000003 | .0000002 |
| 14 | -.0000023 | -.0000011 | -.0000006 | -.0000003 | -.0000001 |
| 15 | .0000020 | .0000010 | .0000005 | .0000003 | .0000001 |
| 16 | -.0000018 | -.0000009 | -.0000005 | -.0000002 | -.0000001 |
| 17 | .0000017 | .0000008 | .0000004 | .0000002 | .0000001 |
| 18 | -.0000015 | -.0000008 | -.0000004 | -.0000002 | -.0000001 |
| 19 | .0000014 | .0000007 | .0000004 | .0000002 | .0000001 |
| 20 | -.0000013 | -.0000007 | -.0000003 | -.0000002 | -.0000001 |
| 21 | .0000012 | .0000006 | .0000003 | .0000002 | .0000001 |
| 22 | -.0000011 | -.0000006 | -.0000003 | -.0000001 | -.0000001 |
| 23 | .0000010 | .0000005 | .0000003 | .0000001 | .0000001 |
| 24 | -.0000010 | -.0000005 | -.0000002 | -.0000001 | -.0000001 |
| 25 | .0000009 | .0000005 | .0000002 | .0000001 | .0000001 |
| 26 | -.0000009 | -.0000004 | -.0000002 | -.0000001 | -.0000001 |
| 27 | .0000008 | .0000004 | .0000002 | .0000001 | .0000001 |
| 28 | -.0000008 | -.0000004 | -.0000002 | -.0000001 | -.0000001 |
| 29 | .0000007 | .0000004 | .0000002 | .0000001 | .0000000 |
| 30 | -.0000007 | -.0000003 | -.0000002 | -.0000001 | .0000000 |

| delta i | beta i 131072 | 262144 | 524288 | 1048576 | 2097152 |
|---|---|---|---|---|---|
| 1 | 1.0000057 | 1.0000055 | 1.0000148 | 1.0000170 | 1.0000304 |
| 2 | -.0000026 | -.0000013 | -.0000006 | -.0000003 | -.0000002 |
| 3 | .0000010 | .0000005 | .0000003 | .0000001 | .0000001 |
| 4 | -.0000006 | -.0000003 | -.0000002 | -.0000001 | .0000000 |
| 5 | .0000004 | .0000002 | .0000001 | .0000000 | .0000000 |
| 6 | -.0000003 | -.0000001 | -.0000001 | .0000000 | .0000000 |
| 7 | .0000002 | .0000001 | .0000001 | .0000000 | .0000000 |
| 8 | -.0000002 | -.0000001 | .0000000 | .0000000 | .0000000 |
| 9 | .0000001 | .0000001 | .0000000 | .0000000 | .0000000 |
| 10 | -.0000001 | -.0000001 | .0000000 | .0000000 | .0000000 |
| 11 | .0000001 | .0000001 | .0000000 | .0000000 | .0000000 |
| 12 | -.0000001 | .0000000 | .0000000 | .0000000 | .0000000 |
| 13 | .0000001 | .0000000 | .0000000 | .0000000 | .0000000 |
| 14 | -.0000001 | .0000000 | .0000000 | .0000000 | .0000000 |
| 15 | .0000001 | .0000000 | .0000000 | .0000000 | .0000000 |
| 16 | -.0000001 | .0000000 | .0000000 | .0000000 | .0000000 |
| 17 | .0000001 | .0000000 | .0000000 | .0000000 | .0000000 |
| 18 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 19 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 20 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 21 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 22 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 23 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 24 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 25 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 26 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 27 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 28 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 29 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 30 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |

beta i

| delta | 4194304 | 8388608 | 16777216 | 33554432 | 67108864 |
|---|---|---|---|---|---|
| i | | | | | |
| 1 | 1.0000388 | 1.0000000 | 1.0000000 | 1.0000000 | 1.0000000 |
| 2 | -.0000001 | .0000000 | .0000000 | .0000000 | .0000000 |
| 3 | .0000000 | .0000000 | .0000000 | .0000001 | .0000000 |
| 4 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 5 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 6 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 7 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 8 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 9 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 10 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 11 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 12 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 13 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 14 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 15 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 16 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 17 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 18 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 19 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 20 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 21 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 22 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 23 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 24 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 25 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 26 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 27 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 28 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 29 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |
| 30 | .0000000 | .0000000 | .0000000 | .0000000 | .0000000 |

```
begin
   integer k,n,i,j,v,s,z,l;
   real eps,sgm,R,h,Eo,xb,Et,ga,gb,Q,sigma,w,dt,a,b,c,d,bt,
        xx,ya,yb,T,Tr,omega,gamma,da,y1,R1,gm1,gmp,dt1,dtp,
        b1,ua,ub,uc,cst;
   array alfa,wa[1:30,1:30],alf,war[1:30];
   read(alfa,wa);
   wait('dane');
   read(k,n,eps,sgm,R);
   begin
      integer array m[1:n];
      array p,temp,ss,st,af[1:n];
      read(m,p,temp);
      v:=0;
      for i:=1 step 1 until n do v:=v+m[i];
      begin
         array X,E,delta[1:v],WW[1:4],WN1,WN2,WN3,WN4,WN5,WN6[1:7];
         switch TE:=QA,QB,QC,QD,QE,QF;
         real procedure F(x);
            value x;
            real x;
            begin
               real p;
               integer i;
               p:=0;
```

```
        for i:=1 step 1 until 4 do p:=p×x+WW[i];
        F:=p×x
    end F;
real procedure CONC(x,delta);
    value x,delta;
    real x,delta;
    begin
        real a,s,t;
        s:=(1/dtp+sqrt(2/delta));
        t:=(1/dtp-sqrt(2/delta))×exp(-sqrt(8/delta)×(da+x));
        a:=sqrt(2/delta)×(s+t)/((s-t)×R);
        s:=(a+b1)/(a-b1);
        CONC:=(s-1)/(s×exp(b1×y1)-exp(-b1×y1))
    end CONC;
real procedure BESSEL(n,x);
    value n,x;
    integer n;
    real x;
    begin
        integer i;
        real p,w,f;
        w:=0;
        if n=0 then go to EA;
        go to if x>3 then ED else EC;
    EA:if x>3 then go to EB;
```

```
   p:=x×x/9;
   for i:=1 step 1 until 7 do
      w:=w×p+WN1[i];
   go to FINISH;
EB:f:=0;
   p:=3/x;
   for i:=1 step 1 until 7 do
      begin
         f:=f×p+WN2[i];
         w:=w×p+WN3[i]
      end;
   w:=f×cos(w+x)/sqrt(x);
   go to FINISH;
EC:p:=x×x/9;
   for i:=1 step 1 until 7 do
      w:=w×p+WN4[i];
   w:=w×x;
   go to FINISH;
ED:f:=0;
   p:=3/x;
   for i:=1 step 1 until 7 do
      begin
         f:=f×p+WN5[i];
         w:=w×p+WN6[i]
      end;
```

```
        w:=f×cos(w+x)/sqrt(x);
FINISH: BESSEL:=w
    end BESSEL;
 WN1[1]:= 0.0002100;
 WN1[2]:=-0.0039444;
 WN1[3]:= 0.0444479;
 WN1[4]:=-0.3163866;
 WN1[5]:= 1.2656208;
 WN1[6]:=-2.2499997;
 WN1[7]:= 1;
 WN2[1]:= 0.00014476;
 WN2[2]:=-0.00072805;
 WN2[3]:= 0.00137237;
 WN2[4]:=-0.00009512;
 WN2[5]:=-0.00552740;
 WN2[6]:=-0.00000077;
 WN2[7]:= 0.79788456;
 WN3[1]:= 0.00013558;
 WN3[2]:=-0.00029333;
 WN3[3]:=-0.00054125;
 WN3[4]:= 0.00262573;
 WN3[5]:=-0.00003954;
 WN3[6]:=-0.04166397;
 WN3[7]:=-0.78539816;
 WN4[1]:= 0.00001109;
```

```
WN4[2]:=-0.00031761;
WN4[3]:= 0.00443319;
WN4[4]:=-0.03954289;
WN4[5]:= 0.21093573;
WN4[6]:=-0.56249985;
WN4[7]:= 0.5;
WN5[1]:=-0.00020033;
WN5[2]:= 0.00113653;
WN5[3]:=-0.00249511;
WN5[4]:= 0.00017105;
WN5[5]:= 0.01659667;
WN5[6]:= 0.00000156;
WN5[7]:= 0.79788456;
WN6[1]:=-0.00029166;
WN6[2]:= 0.00079824;
WN6[3]:= 0.00074348;
WN6[4]:=-0.00637879;
WN6[5]:= 0.00005650;
WN6[6]:= 0.12499612;
WN6[7]:=-2.35619449;
WW[1]:= 1.48098339⏨-11;
WW[2]:=-3.60121584⏨-8;
WW[3]:= 4.62395134⏨-5;
WW[4]:= 3.85014117⏨-2;
da:=30;
```

```
y1:=30;
R1:=1.75;
gm1:=1⏨-4;
gmp:=1⏨-4;
read(X,E);  h:=0.5;  v:=0;
for i:=1 step 1 until n do
   begin
      Eo:=F(temp[i]);
      for j:=1 step 1 until m[i] do
         begin
            xb:=0;
            Et:=Eo+E[v+j]/100;
            if Et=0 then go to ZD;
            if Et<0 then h:=-abs(h) else h:=abs(h);
            if F(xb) -Et<0 then go to ZB;
         ZA:if F(xb) -Et>0 then
               begin
                  xb:=xb+h;   go to ZA
               end;
            ga:=xb;  gb:=xb-h;  go to ZC;
         ZB:if F(xb) -Et<0 then
               begin
                  xb:=xb+h;  go to ZB
               end;
            gb:=xb;  ga:=xb-h;
```

```
        ZC:xb:=(ga+gb)/2;
           if F(xb) -Et>0 then gb:=xb else ga:=xb;
           if abs(ga-gb)>1₁₀-8 then go to ZC;
        ZD:delta[v+j]:=xb-temp[i]
        end;
     v:=v+m[i]
  end;
v:=0;
for i:=1 step 1 until n do st[i]:=0;
for i:=1 step 1 until n do
  begin
     a:=b:=c:=d:=0;
     for j:=1 step 1 until m[i] do
        begin
           a:=a+X[v+j];
           b:=b+ln(delta[v+j]);
           c:=c+X[v+j]×X[v+j];
           d:=d+X[v+j]×ln(delta[v+j])
        end;
     xb:=m[i]×c-a×a;
     af[i]:=(m[i]×d-a×b)/xb;
     bt:=(b×c-a×d)/xb;
     xb:=exp(bt+af[i]×X[v+1]);
     for j:=2 step 1 until m[i]-1 do
        begin
```

```
                delta[v+j]:=delta[v+j]/xb;
                X[v+j]:=X[v+1]-X[v+j];
                st[i]:=st[i]+(ln(delta[v+j])+af[i]×X[v+j])↑2
             end;
          v:=v+m[i]
       end;
    line(1);
    print('Experiment␣no␣');  format('11');  print(k);
    line(2);
print('No␣␣␣␣␣␣␣␣␣␣T␣␣␣␣␣␣␣␣␣␣␣p␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣gamma␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣1000/T␣␣␣␣␣␣␣ln(gamma)
␣␣␣␣␣␣␣␣␣[deg␣K]␣␣␣␣␣␣[torr]␣␣␣␣␣␣␣Present␣␣␣␣␣Smith␣Linnett
␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣␣analysis␣␣␣␣␣␣␣analysis');
format('?11␣␣␣␣␣␣␣␣111.1␣␣␣␣␣␣␣.111␣␣␣␣␣␣␣␣1.11⏨-1␣␣␣␣␣␣␣␣1.11⏨-1␣␣␣␣␣␣␣␣1.111␣␣␣␣␣␣␣-1.111⏨-1');
    line(1);
    v:=0;
    for i:=1 step 1 until n do
       begin
          T:=temp[i]+273;
          Tr:=T/eps;
          omega:=1.075×exp(-0.1615×ln(Tr));
          omega:=omega+2×exp(-0.321377916 6×ln(10×Tr)×ln(10×Tr));
          dt1:=0.4756087837×T/(gm1×R1×p[i]×sgm×sgm×omega);
          dtp:=0.4756087837×T/(gmp×R×p[i]×sgm×sgm×omega);
          b1:=sqrt(2/dt1)/R1;
          go to P;
```

```
LA:Q:=0;
   cst:=CONC(0.0,0.125×2↑(l-1));
   for j:=2 step 1 until m[i]-1 do
      begin
         sigma:=0;
         s:=1;
      CA:ua:=alfa[l,s]×dtp+1;
         ub:=exp(-2×alfa[l,s]×da/R);
         uc:=exp(-alfa[l,s]×X[v+j]/R);
         w:=wa[l,s]×(ua+(ua-2)×ub)×uc/(ua+(ua-2)×ub×uc×uc);
         s:=s+1;
         sigma:=sigma+w;
         if abs(w)>1_10-8 then go to CA;
         sigma:=CONC(X[v+j],0.125×2↑(l-1))×sigma/cst;
         Q:=Q+(ln(delta[v+j])-ln(sigma))↑2
      end;
   go to TE[z];
LB:sigma:=xb:=0;
   j:=1;
   cst:=CONC(0.0,dt);
AB:if BESSEL(0,xb)<dt×xb×BESSEL(1,xb) then go to YB;
YA:if BESSEL(0,xb)>dt×xb×BESSEL(1,xb) then
      begin
         xb:=xb+1;
         go to YA
```

```
        end;
    ga:=xb;   gb:=xb-1;   go to YC;
YB: if BESSEL(0,xb)<dt×xb×BESSEL(1,xb) then
        begin
            xb:=xb+1;
            go to YB
        end;
    gb:=xb;   ga:=xb-1;
YC: xb:=(ga+gb)/2;
    if BESSEL(0,xb)>dt×xb×BESSEL(1,xb) then gb:=xb
                                       else ga:=xb;
    if abs(ga-gb)>1₁₀-8 then go to YC;
    alf[j]:=xb;
    war[j]:=2/(xb×(1+xb×xb×dt×dt)×BESSEL(1,xb));
    ua:=alf[j]×dtp+1;
    ub:=exp(-2×alf[j]×da/R);
    uc:=exp(-alf[j]×X[v+m[i]-1]/R);
    w:=war[j]×(ua+(ua-2)×ub)×uc/(ua+(ua-2)×ub×uc×uc);
    sigma:=sigma+w;
    j:=j+1;
    xb:=xb+1;
    if abs(w)>1₁₀-8 then go to AB;
    sigma:=CONC(X[v+m[i]-1],dt)×sigma/cst;
    Q:=(ln(delta[v+m[i]-1])-ln(sigma))↑2;
    for j:=2 step 1 until m[i]-2 do
```

```
        begin
            sigma:=0;
            s:=1;
        DA:ua:=alf[s]×dtp+1;
            ub:=exp(-2×alf[s]×da/R);
            uc:=exp(-alf[s]×X[v+j]/R);
            w:=war[s]×(ua+(ua-2)×ub)×uc/(ua+(ua-2)×ub×uc×uc);
            s:=s+1;
            sigma:=sigma+w;
            if abs(w)>1₁₀-8 then go to DA;
            sigma:=CONC(X[v+j],dt)×sigma/cst;
            Q:=Q+(ln(delta[v+j])-ln(sigma))↑2
        end;
    go to TE[z];
  P:xx:=0.125;
    l:=1;
    z:=1;
    go to LA;
QA:a:=Q;
    l:=2;
    z:=2;
    go to LA;
QB:b:=Q;
    l:=3;
    z:=3;
```

```
    go to LA;
QC: c:=Q;
    if a>b∧c>b then go to XC;
    xx:=2×xx;
    l:=l+1;
    a:=b;
    b:=c;
    go to LA;
XC: h:=xx;
    dt:=3×xx;
    z:=4;
    go to LB;
QD: ya:=Q;
    if a>b∧ya>b then
        begin
            c:=ya;
            go to XB
        end;
    xx:=xx+h;
    a:=b;
    b:=ya;
XB: if 2×h<1⏨-8 then go to SOL;
    h:=h/2;
    dt:=xx+h;
    z:=5;
```

```
    go to LB;
QE:ya:=Q;
    if a≥ya∧b≥ya then
        begin
            c:=b;
            b:=ya;
            go to XB
        end;
    dt:=xx+3×h;
    z:=6;
    go to LB;
QF:yb:=Q;
    if ya≥b∧yb≥b then
        begin
            xx:=xx+h;
            a:=ya;
            c:=yb;
            go to XB
        end;
    xx:=xx+2×h;
    a:=b;
    b:=yb;
    go to XB;
SOL:xx:=xx+h;
    gamma:=0.4756087837×T/(xx×R×p[i]×sgm×sgm×omega);
```

```
                w:=2/(af[i]×af[i]×R×R);
                w:=0.4756087837×T/(w×R×p[i]×sgm×sgm×omega);
                print(i,T,p[i]/1000,gamma,w,1000/T,ln(gamma));
                ss[i]:=b;
                v:=v+m[i]
            end;
        line(15);
        print('Experiment␣no␣');  format('11');
        print(k);   line(1);
        print('␣␣␣␣Sum␣of␣the␣least␣squares
No␣␣␣␣␣␣␣␣one␣dim␣␣␣␣␣␣␣␣three␣dim
␣␣␣␣␣␣␣␣equation␣␣␣␣␣␣␣␣equation');
        format('?11␣␣␣␣␣␣␣1.111₁₀-11␣␣␣␣␣␣␣1.111₁₀-11');
        line(1);
        for i:=1 step 1 until n do print(i,st[i],ss[i]);
        line(15)
    end
  end
end?
```