x bar chart (using r)

```
n = 20;
A2 =0.18;
c4 = []; %蒐集第一次out-of-control之array

for j = 1:10000
    M = randn(1, n);
    x_bb = mean(M);
    r_b = max(M) - min(M);
    LCL = x_bb - A2 * r_b;
    UCL = x_bb + A2 * r_b;
    random_matrix = randn(10000, n);
    row_means = mean(random_matrix, 2);
    for i = 1:10000
      if row_means(i)>UCL || row_means(i)<LCL
           i;
           c4 = [c4, i];
           break;
      end
    end
end

fprintf('%f',mean(c4))
```

```
368.145097
```

x bar chart (using s)

```
n = 10;
A3 =0.975;
c5 = []; %蒐集第一次out-of-control之array

for j = 1:10000
    M = randn(1, n);
    x_bb = mean(M);
    r_b = std(M);
    LCL = x_bb - A3 * r_b;
    UCL = x_bb + A3 * r_b;
    random_matrix = randn(10000, n);
    row_means = mean(random_matrix, 2);
    for i = 1:10000
      if row_means(i)>UCL || row_means(i)<LCL
           i;
           c5 = [c5, i];
           break;
      end
    end
end

fprintf('%f',mean(c5))
```

```
429.835325
```

R chart(no sigma given)

```
n = 16;
D3 = 0.363;
D4 = 1.637;
c6 = []; %蒐集第一次out-of-control之array

for j = 1:10000
    M = randn(1, n);
    x_bb = mean(M);
    r_b = max(M)-min(M);
    LCL =  D3 * r_b;
    UCL =  D4 * r_b;
    random_matrix = randn(10000, n);
    row_range = max(random_matrix, [], 2) - min(random_matrix, [], 2);
    for i = 1:10000
      if row_range(i)>UCL || row_range(i)<LCL
           i;
           c6 = [c6, i];
           break;
      end
    end
end

fprintf('%f',mean(c6))
```

```
452.247425
```

S chart(no sigma given)

```
n = 19;
B3 = 0.497 ;
B4 = 1.503;
c7 = []; %蒐集第一次out-of-control之array

for j = 1:50000
    M = randn(1, n);
    x_bb = mean(M);
    r_b = std(M);
    LCL =  B3 * r_b;
    UCL =  B4 * r_b;
    random_matrix = randn(50000, n);
    row_std = std(random_matrix,0, 2);
    for i = 1:50000
      if row_std(i)>UCL || row_std(i)<LCL
           i;
           c7 = [c7, i];
           break;
      end
    end
end

fprintf('%f',mean(c7))
```