附录

附录1：KS检验.py

此代码用于进行KS检验。

|  |
| --- |
| #!/usr/bin/env python # coding: utf-8  # In[1]:   import numpy as np import pandas as pd data = pd.read\_excel('data2.xlsx', index\_col=1, header=0, parse\_dates=True) data.drop(data.columns[0], axis=1, inplace=True)   # In[2]:   data\_np=np.array(data) data\_np   # 已经转为np类型了。  # In[10]:   import copy import scipy.stats as stats from scipy.stats import ks\_2samp   # In[12]:   ans1=np.zeros(120).reshape(3,40) for i in range(40):     slct=data\_np[:,i]     slct=np.sort(slct)     M=np.max(slct)     m=np.min(slct)     seq=np.arange(m,M,(M-m)/50)     print(ks\_2samp(slct,seq) )        # In[26]:   ans2=pd.DataFrame(ans1) ans2.to\_excel('EVEN.xlsx')   # In[ ]: |

附录2：SW检验.py

此代码用于进行SW检验。

|  |
| --- |
| #!/usr/bin/env python # coding: utf-8  # In[53]:   import numpy as np import pandas as pd data = pd.read\_excel('data2.xlsx', index\_col=1, header=0, parse\_dates=True) data.drop(data.columns[0], axis=1, inplace=True)   # In[54]:   data\_np=np.array(data) data\_np.shape   # 已经转为np类型了。  # In[55]:   import copy import scipy.stats as stats   # In[60]:   ans1=np.zeros(120).reshape(3,40) for i in range(40):     slct=data\_np[i,:]     sta,pvalue=stats.shapiro(slct)     ans1[0,i]=sta     ans1[1,i]=pvalue     if (pvalue>=0.05):         ans1[2,i]=1     else:         ans1[2,i]=0   # In[62]:   ans2=pd.DataFrame(ans1) ans2.to\_excel('Gauss\_dealed.xlsx')   # In[58]:   print(stats.shapiro(slct)) |

附录3：t3\_data\_generate.py

此代码用于生成第三题中的随机化数据。

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| --- |
| #!/usr/bin/env python  # coding: utf-8  # In[1]:  import numpy as np  import pandas as pd  import copy  import scipy.stats as stats  # In[4]:  data = pd.read\_excel('t3\_in.xlsx', index\_col=0, header=0, parse\_dates=True)  # In[6]:  data\_np=np.array(data)  data\_np.shape  # In[16]:  import math  # In[15]:  import random  # In[31]:  tar=np.arange(1,100001,1).reshape(100000,1)  # In[32]:  for i in range(40):  tmp=np.random.normal(loc=data\_np[i,0],scale=math.sqrt( data\_np[i,1] ),size =(100000,1) )  tar=np.concatenate ([tar,tmp],axis=1)  # In[33]:  ans2=pd.DataFrame(tar)  ans2.to\_excel('t3\_data\_generate.xlsx')  # In[ ]: |

附录4：t2.cpp

用于第二题的计算。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  double t[11][5];  double minT; //记录最短时间  vector<int>v; //记录当前的序列  vector<int>minV; //记录最小时间所对应的序列  bool u[11]; //是否可以用：可用1，已用0  int tmp;  void init(){  minV.clear();  v.clear();  minT=45000;  for(int i=0;i<=10;i++)u[i]=1;  tmp=0;  }  double test(){  double et[5][11];  //et[i][j]表示第i阶段 第j种疫苗的结束时间。  for(int j=0;j<=10;j++)et[0][j]=0;  for(int i=1;i<=4;i++)et[i][0]=0;  for(int i=1;i<=4;i++){  for(int j=1;j<=10;j++){  et[i][j]=t[ v[j-1] ][i] + max( et[i][j-1] , et[i-1][j] );  }  }  return et[4][10];  }  void OUT(vector<int>tmpv){  for(int i=0;i<v.size();i++){  printf("%d ",tmpv[i]);  }  printf("\n");  }  void DO(){  if(v.size()==10){  double currentT=test();  if(currentT<minT){  minT=currentT;  minV=v;  }  tmp++;  //OUT(v);  //tmp为测试用数据    return;  }  for(int i=1;i<=10;i++){  if(u[i]){  u[i]=0;  v.push\_back(i);  DO();  v.pop\_back();  u[i]=1;  }  }  }  int main(){  init();  freopen("t2\_in.txt","r",stdin);  freopen("t2\_out.txt","w",stdout);  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++)scanf("%lf",&t[i][j]);  }  DO();  printf("%.4lf\n",minT);  for(int i=1;i<=10;i++){  printf("%d\t",minV[i-1]);  }  return 0;  } |

附录5：t2\_输出结果.cpp

用于显示第二题的结果。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  double t[11][5];  double minT; //记录最短时间  vector<int>v; //记录当前的序列  vector<int>minV; //记录最小时间所对应的序列  bool u[11]; //是否可以用：可用1，已用0  int tmp;  void init(){  minV.clear();  v.clear();  minT=45000;  for(int i=0;i<=10;i++)u[i]=1;  tmp=0;  }  double test(){  double et[5][11];  //et[i][j]表示第i阶段 第j种疫苗的结束时间。  for(int j=0;j<=10;j++)et[0][j]=0;  for(int i=1;i<=4;i++)et[i][0]=0;  for(int i=1;i<=4;i++){  for(int j=1;j<=10;j++){  et[i][j]=t[ v[j-1] ][i] + max( et[i][j-1] , et[i-1][j] );  }  }  return et[4][10];  }  void OUT(vector<int>tmpv){  for(int i=0;i<v.size();i++){  printf("%d ",tmpv[i]);  }  printf("\n");  }  void DO(){  if(v.size()==10){  double currentT=test();  if(currentT<minT){  minT=currentT;  minV=v;  }  tmp++;  //OUT(v);  //tmp为测试用数据    return;  }  for(int i=1;i<=10;i++){  if(u[i]){  u[i]=0;  v.push\_back(i);  DO();  v.pop\_back();  u[i]=1;  }  }  }  int main(){  init();  freopen("t2\_in.txt","r",stdin);  freopen("t2\_out\_result.txt","w",stdout);  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++)scanf("%lf",&t[i][j]);  }  DO();  printf("总时间:\n%.4lf\n顺序：\n",minT);  for(int i=1;i<=10;i++){  printf("%d\t",minV[i-1]);  }  printf("\n");  printf("编号\t开始\t结束\n");  double Et[5][11];  //Et[i][j]表示第i阶段 第j种疫苗的结束时间。  for(int j=0;j<=10;j++)Et[0][j]=0;  for(int i=1;i<=4;i++)Et[i][0]=0;  for(int i=1;i<=4;i++){  for(int j=1;j<=10;j++){  Et[i][j]=t[ minV[j-1] ][i] + max( Et[i][j-1] , Et[i-1][j] );  }  }  for(int j=0;j<10;j++){  printf("%d\t%.4lf\t%.4lf\n", minV[j] , Et[1][j+1]-t[ minV[j] ][1] , Et[4][j+1] );  }    return 0;  } |

附录6：t3\_data1.cpp

用于从第三题生成的数剧中取出一部分并计算。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  double t[11][5];  double minT; //记录最短时间  vector<int>v; //记录当前的序列  vector<int>minV; //记录最小时间所对应的序列  bool u[11]; //是否可以用：可用1，已用0  int tmp;  void init(){  minV.clear();  v.clear();  minT=45000;  for(int i=0;i<=10;i++)u[i]=1;  tmp=0;  }  double test(){  double et[5][11];  //et[i][j]表示第i阶段 第j种疫苗的结束时间。  for(int j=0;j<=10;j++)et[0][j]=0;  for(int i=1;i<=4;i++)et[i][0]=0;  for(int i=1;i<=4;i++){  for(int j=1;j<=10;j++){  et[i][j]=t[ v[j-1] ][i] + max( et[i][j-1] , et[i-1][j] );  }  }  return et[4][10];  }  void OUT(vector<int>tmpv){  for(int i=0;i<v.size();i++){  printf("%d ",tmpv[i]);  }  printf("\n");  }  void DO(){  if(v.size()==10){  double currentT=test();  if(currentT<minT){  minT=currentT;  minV=v;  }  tmp++;  //OUT(v);  //tmp为测试用数据    return;  }  for(int i=1;i<=10;i++){  if(u[i]){  u[i]=0;  v.push\_back(i);  DO();  v.pop\_back();  u[i]=1;  }  }  }  int main(){  freopen("t3\_data1\_in.txt","r",stdin);  freopen("t3\_data1\_out.txt","w",stdout);  int SS;  scanf("%d",&SS);  for(int I=0;I<100;I++){  init();  for(int i=1;i<=10;i++)for(int j=1;j<=4;j++)scanf("%lf",&t[i][j]);  DO();  printf("%.4lf\n",minT);  }  return 0;  } |

附录7：t3\_data1\_analyse.cpp

用于第三题分析

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  int a[200];  int main(){  int N=0;  freopen("t3\_data1\_out.txt","r",stdin);  freopen("t3\_data1\_analyse.txt","w",stdout);  double t;  memset(a,0,sizeof(a));  while(~scanf("%lf",&t)){  if(t<177)t=177;  if(t>191)t=191;  int s=t;  // cout<<s<<endl;  a[s]++;  }  for(int i=177;i<=191;i++){  printf("%d\n",a[i]);  }  return 0;  } |

附录8：t4.cpp

用于第四题的计算。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  double sum[10]; //该种疫苗所需时间  double total; // 总时间  double t[10][4];  double quan[10];  void init(){  memset(sum,0,sizeof(sum));  memset(t,0,sizeof(t));  memset(quan,0,sizeof(quan));  total=0;    }  int main(){  init();  freopen("t4\_in.txt","r",stdin);  freopen("t4\_out2.txt","w",stdout);  for(int i=0;i<10;i++)scanf("%lf",&quan[i]);  for(int i=0;i<10;i++){  for(int j=0;j<4;j++)scanf("%lf",&t[i][j]);  sum[i]=max(  max(  t[i][3]+t[i][2]+t[i][1]+quan[i]\*t[i][0],  t[i][3]+t[i][2]+quan[i]\*t[i][1]+t[i][0]  ),  max(  t[i][3]+quan[i]\*t[i][2]+t[i][1]+t[i][0],  quan[i]\*t[i][3]+t[i][2]+t[i][1]+t[i][0]  )  );  total+=sum[i];  printf("%.4lf\n",sum[i]);  }  printf("共 %.4lf 分钟\n",total);  return 0;  } |

附录9：t5.cpp

用于编辑第五题的lingo程序。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  int main(){  freopen("t5\_in.txt","r",stdin);  freopen("t5\_out.txt","w",stdout);  double a[11][5];  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++)scanf("%lf",&a[i][j]);  }  for(int j=1;j<=4;j++){  for(int i=1;i<=10;i++){  printf("+%.4lfx%d",a[i][j],i);  }  printf("<=96000\n");  }  return 0;  } |

附录10：t5\_2.cpp

用于编辑lingo的输出（第五题）。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  double q[11];  double sum[11];  int main(){  freopen("t5\_2\_in.txt","r",stdin);  freopen("t5\_2\_out.txt","w",stdout);  double a[11][5];  for(int i=1;i<=10;i++)scanf("%lf",&q[i]);  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++)scanf("%lf",&a[i][j]);  }  for(int j=1;j<=4;j++){  for(int i=1;i<=10;i++){  sum[j]+=q[i]\*a[i][j];  }  printf("第 %d 个工位剩余时间： %.4lf\n",j,96000-sum[j]);  }  return 0;  } |

附录11：t5\_3\_结果分析.cpp

用于第五题结果分析。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  double q[11];  double sum[11];  int main(){  freopen("t5\_2\_in.txt","r",stdin);  freopen("t5\_3\_out.txt","w",stdout);  double a[11][5];  for(int i=1;i<=10;i++)scanf("%lf",&q[i]);  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++)scanf("%lf",&a[i][j]);  }  for(int j=1;j<=4;j++){  for(int i=1;i<=10;i++){  printf("%.4lf\t",a[i][j]);  }    printf("\n");  }  return 0;  } |

附录12：t5\_4.cpp

用于在第五题中计算剩余时间，以便调整方案。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  double q[11];  double sum[11];  int main(){  freopen("t5\_4\_in.txt","r",stdin);  freopen("t5\_4\_out.txt","w",stdout);  double a[11][5];  for(int i=1;i<=10;i++)scanf("%lf",&q[i]);  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++)scanf("%lf",&a[i][j]);  }  for(int j=1;j<=4;j++){  for(int i=1;i<=10;i++){  sum[j]+=q[i]\*a[i][j];  }  printf("第 %d 个工位剩余时间： %.4lf\n",j,96000-sum[j]);  }  return 0;  } |

附录13：离群点处理.cpp

用于预处理。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  int main(){  double a[50];  double var=0,ave=0;  freopen("input1.txt","r",stdin);  freopen("output1.txt","w",stdout);  for(int i=0;i<50;i++){  scanf("%lf",&a[i]);  }  scanf("%lf%lf",&ave,&var);  for(int i=0;i<50;i++){  double dis=2\*pow(var,0.5);  if( abs(a[i]-ave)>dis )printf("%.4lf\t",ave);  else printf("%.4lf\t",a[i]);  }  return 0;  } |

附录14：转换格式.cpp

用于转换附件中的数据格式。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  int main(){  freopen("Trans\_in.txt","r",stdin);  freopen("Trans\_out.txt","w",stdout);  double a[55];  for(int J=0;J<40;J++){  for(int i=0;i<50;i++){  cin>>a[i];  printf("%.4lf\t",a[i]);  }  printf("\n");  }  return 0;  } |

附录15：t3\_2.cpp

用于第三题数据处理。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  int ind[50][11];  double ave[50];  double raw[11][5];  double aft[11][5];  double et[11][5]; //结束时间  double test(){  //et[i][j]表示第i阶段 第j种疫苗的结束时间。  for(int i=0;i<=10;i++)et[i][0]=0;  for(int j=1;j<=4;j++)et[0][j]=0;  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++){  et[i][j]=aft[i][j] + max( et[i][j-1] , et[i-1][j] );  }  }  return et[10][4];  }  int main(){  freopen("t3\_2\_in.txt","r",stdin);  freopen("t3\_2\_out.txt","w",stdout);  int r,N;  scanf("%d",&r);  for(int i=0;i<r;i++){  for(int j=1;j<=10;j++)scanf("%d",&ind[i][j]);  ave[i]=0;  }  //CK  scanf("%d",&N);  for(int I=0;I<N;I++){ //对于每一组数据  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++){  scanf("%lf",&raw[i][j]);  // printf("%.1lf\t",raw[i][j]);  }  // printf("\n");  }  // CK  for(int k=0;k<r;k++){ //测试每一种排列  for(int i=1;i<=10;i++){  // cout<<ind[k][i]<<endl;  for(int j=1;j<=4;j++){  aft[ ind[k][i] ][j]=raw[ i ][j];    }    }  //CK  double ans=test();  // cout<<ans;  ave[k]+=ans/N;  }  }  double mina=1000;  int min\_ind=0;  for(int k=0;k<r;k++){  printf("%.4lf\n",ave[k]);  if(mina>ave[k]){  mina=ave[k];  min\_ind=k;  }  }    printf("\nmin:%.4lf\n",mina);  for(int i=1;i<=10;i++){  printf("%d\t",ind[min\_ind][i]);  }    return 0;  } |

附录16：t3\_3.cpp

用于测试第三题结果。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  int ind[11];  double ans[6050];  double raw[11][5];  double aft[11][5];  double et[11][5]; //结束时间  double test(){  //et[i][j]表示第i阶段 第j种疫苗的结束时间。  for(int i=0;i<=10;i++)et[i][0]=0;  for(int j=1;j<=4;j++)et[0][j]=0;  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++){  et[i][j]=aft[i][j] + max( et[i][j-1] , et[i-1][j] );  }  }  return et[10][4];  }  int main(){  memset(ans,0,sizeof(ans));  freopen("t3\_3\_in.txt","r",stdin);  freopen("t3\_3\_out.txt","w",stdout);  int r,N;  for(int j=1;j<=10;j++)scanf("%d",&ind[j]);  //CK  scanf("%d",&N);  for(int I=0;I<N;I++){ //对于每一组数据  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++){  scanf("%lf",&raw[i][j]);  }  }  for(int i=1;i<=10;i++){  for(int j=1;j<=4;j++){  aft[ ind[i] ][j]=raw[ i ][j];  }  }  ans[I]=test();  printf("%.4lf\n",ans[I]);  }      return 0;  } |

附录17：t3\_data1\_check\_result.cpp

用于检验第三题。

|  |
| --- |
| #include<bits/stdc++.h>  using namespace std;  typedef long long ll;  const int INF=0x3f3f3f3f;  const long long mod=100000007;  const double e=2.718281828459045;  const double pi=3.1415926535;  #define CK cout<<"OK\n";  double t[11][5];  double minT; //记录最短时间  vector<int>v; //记录当前的序列  vector<int>minV; //记录最小时间所对应的序列  bool u[11]; //是否可以用：可用1，已用0  int tmp;  void init(){  minV.clear();  v.clear();  minT=45000;  for(int i=0;i<=10;i++)u[i]=1;  tmp=0;  }  double test(){  double et[5][11];  //et[i][j]表示第i阶段 第j种疫苗的结束时间。  for(int j=0;j<=10;j++)et[0][j]=0;  for(int i=1;i<=4;i++)et[i][0]=0;  for(int i=1;i<=4;i++){  for(int j=1;j<=10;j++){  et[i][j]=t[ v[j-1] ][i] + max( et[i][j-1] , et[i-1][j] );  }  }  return et[4][10];  }  void OUT(vector<int>tmpv){  for(int i=0;i<tmpv.size();i++){  printf("%d ",tmpv[i]);  }  printf("\n");  }  void DO(){  if(v.size()==10){  double currentT=test();  if(currentT<minT){  minT=currentT;  minV=v;  }  tmp++;  //OUT(v);  //tmp为测试用数据    return;  }  for(int i=1;i<=10;i++){  if(u[i]){  u[i]=0;  v.push\_back(i);  DO();  v.pop\_back();  u[i]=1;  }  }  }  int main(){  freopen("t3\_data1\_in.txt","r",stdin);  freopen("t3\_data1\_out\_check\_result.txt","w",stdout);  int SS;  scanf("%d",&SS);  for(int I=0;I<30;I++){  init();  for(int i=1;i<=10;i++)for(int j=1;j<=4;j++)scanf("%lf",&t[i][j]);  DO();  printf("%.4lf\n",minT);  OUT(minV);  }  return 0;  } |

附录18：预处理后的数据

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 疫苗类型 The vaccine type | 生产工位Production location | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| YM1 | CJ1 | 13.5377 | 11.6923 | 11.6501 | 12.795 | 13.6715 | 14.0347 | 13.8884 | 14.4384 |
| YM1 | CJ2 | 14.1363 | 16.5326 | 13.9109 | 15.0859 | 14.3844 | 13.5977 | 16.4193 | 15.6966 |
| YM1 | CJ3 | 20.8404 | 19.3997 | 17.8616 | 20.124 | 22.908 | 19.7275 | 19.6462 | 20.0335 |
| YM1 | CJ4 | 20.7801 | 19.8002 | 19.5594 | 20.4613 | 18.002 | 20.6775 | 17.9575 | 21.5586 |
| YM2 | CJ1 | 10.1832 | 10.5152 | 9.468 | 8.8258 | 8.9358 | 9.5554 | 10.3919 | 9.6794 |
| YM2 | CJ2 | 19.2658 | 19.7635 | 21.0001 | 18.3298 | 20.3271 | 19.0556 | 20.9111 | 20.2398 |
| YM2 | CJ3 | 18.0799 | 17.3088 | 18.8979 | 17.4954 | 16.9851 | 18.3999 | 17.3709 | 17.4393 |
| YM2 | CJ4 | 19.881 | 18.3955 | 18.5323 | 19.3086 | 17.5306 | 18.0953 | 21.4245 | 20.8779 |
| YM3 | CJ1 | 20.2696 | 20.1097 | 21.1741 | 20.8186 | 19.507 | 20.1093 | 20.5265 | 18.673 |
| YM3 | CJ2 | 15.9372 | 14.8813 | 15.3593 | 15.2764 | 15.6269 | 16.4128 | 16.1769 | 15.802 |
| YM3 | CJ3 | 14.9201 | 15.44 | 13.8593 | 15.5413 | 13.7167 | 15.0355 | 15.2458 | 13.6571 |
| YM3 | CJ4 | 14.5619 | 14.4684 | 14.586 | 15.6489 | 16.0289 | 13.7629 | 15.4136 | 14.1812 |
| YM4 | CJ1 | 8.4759 | 7.4903 | 9.0341 | 8.2445 | 8.9239 | 7.5836 | 8.0645 | 7.0605 |
| YM4 | CJ2 | 8.5173 | 8.3727 | 12.0243 | 10.3179 | 10.6474 | 11.0635 | 9.2422 | 9.5907 |
| YM4 | CJ3 | 6.3817 | 6.138 | 5.7168 | 6.1559 | 6.0829 | 5.897 | 5.9654 | 5.7147 |
| YM4 | CJ4 | 19.46 | 17.4073 | 18.4207 | 18.9704 | 16.8067 | 16.4495 | 19.0533 | 20.7891 |
| YM5 | CJ1 | 9.5411 | 9.412 | 9.8535 | 9.4772 | 8.5901 | 8.4565 | 9.9758 | 9.5409 |
| YM5 | CJ2 | 12.5807 | 11.7967 | 12.8777 | 12.7706 | 13.5902 | 12.5331 | 14.257 | 12.3067 |
| YM5 | CJ3 | 13.4364 | 11.9632 | 13.1807 | 12.2255 | 14.7985 | 13.7653 | 12.2397 | 13.2147 |
| YM5 | CJ4 | 10.7494 | 12.7447 | 10.6988 | 11.8836 | 10.4862 | 11.2877 | 9.4434 | 11.551 |
| YM6 | CJ1 | 19.6737 | 18.2219 | 18.6481 | 20.0393 | 19.0964 | 19.8368 | 20.3025 | 19.2268 |
| YM6 | CJ2 | 21.1665 | 19.6182 | 20.0675 | 20.1946 | 21.4089 | 19.1024 | 20.5275 | 20.353 |
| YM6 | CJ3 | 13.9583 | 14.2053 | 12.3636 | 13.4632 | 15.3094 | 14.7304 | 14.5745 | 14.7932 |
| YM6 | CJ4 | 11.9716 | 14.617 | 13.5023 | 13.5178 | 14.2087 | 13.8839 | 14.553 | 13.7211 |
| YM7 | CJ1 | 12.3419 | 10.3813 | 11.6329 | 11.9493 | 12.6894 | 11.3847 | 10.2103 | 9.9248 |
| YM7 | CJ2 | 16.321 | 16.1944 | 17.771 | 17.5826 | 14.6801 | 15.9724 | 16.1568 | 18.1257 |
| YM7 | CJ3 | 11.5951 | 11.6962 | 12.397 | 12.5684 | 11.7808 | 12.1173 | 12.4583 | 11.7545 |
| YM7 | CJ4 | 18.4259 | 19.7495 | 19.7768 | 19.0049 | 18.8198 | 19.1478 | 19.1789 | 18.5797 |
| YM8 | CJ1 | 14.4856 | 16.4488 | 16.8598 | 17.1458 | 17.4254 | 14.0555 | 16.0115 | 17.0458 |
| YM8 | CJ2 | 8.6982 | 8.4936 | 8.935 | 8.2935 | 8.3998 | 8.2069 | 8.7126 | 8.8275 |
| YM8 | CJ3 | 16.3152 | 17.4721 | 19.6865 | 18.968 | 19.3769 | 17.3752 | 17.1167 | 17.7175 |
| YM8 | CJ4 | 17.4274 | 17.0188 | 17.8254 | 17.0939 | 18.1929 | 17.523 | 17.3792 | 17.3276 |
| YM9 | CJ1 | 12.8254 | 15.2918 | 15.8352 | 15.4948 | 14.6064 | 15.7402 | 14.746 | 13.0461 |
| YM9 | CJ2 | 12.7973 | 12.1674 | 13.1654 | 11.4488 | 10.9958 | 10.3646 | 10.4562 | 13.3162 |
| YM9 | CJ3 | 6.6825 | 6.9448 | 6.5514 | 7.4019 | 6.6919 | 6.8599 | 7.3434 | 6.3337 |
| YM9 | CJ4 | 9.113 | 8.9394 | 9.6333 | 9.4329 | 8.9738 | 8.8978 | 8.4983 | 8.354 |
| YM10 | CJ1 | 12.7739 | 12.748 | 12.9133 | 13.0979 | 13.138 | 12.4625 | 13.5046 | 13.3015 |
| YM10 | CJ2 | 6.71 | 7.5018 | 7.4571 | 7.1321 | 7.1059 | 6.3132 | 6.5245 | 7.136 |
| YM10 | CJ3 | 9.7264 | 8.6719 | 9.3712 | 9.1924 | 8.7475 | 9.4649 | 9.8025 | 9.2004 |
| YM10 | CJ4 | 15.5279 | 15.6108 | 15.6592 | 16.2751 | 16.3192 | 16.5168 | 15.8662 | 17.4872 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 疫苗类型 The vaccine type | 生产工位Production location | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| YM1 | CJ1 | 12.8978 | 12.9699 | 14.8339 | 12.5664 | 16.0349 | 12.8759 | 11.7925 | 13.7269 |
| YM1 | CJ2 | 13.852 | 15.1873 | 15.0774 | 14.2303 | 15.0326 | 13.5084 | 15.7481 | 13.5776 |
| YM1 | CJ3 | 20.0229 | 19.0208 | 19.112 | 20.49 | 19.1604 | 21.4367 | 20.8252 | 21.0984 |
| YM1 | CJ4 | 19.7072 | 21.2391 | 19.97 | 18.9282 | 18.7281 | 18.1143 | 16.5052 | 19.8046 |
| YM2 | CJ1 | 8.9333 | 8.4349 | 8.9702 | 10.2614 | 11.6821 | 9.8078 | 11.6035 | 9.8441 |
| YM2 | CJ2 | 19.9755 | 19.9292 | 19.9692 | 22.0237 | 18.3358 | 20.4716 | 21.0826 | 18.6782 |
| YM2 | CJ3 | 16.6019 | 19.5763 | 17.0515 | 18.4494 | 17.8681 | 16.7294 | 17.5289 | 17.07 |
| YM2 | CJ4 | 18.4417 | 18.7901 | 19.3232 | 19.1034 | 18.8751 | 18.7661 | 19.1922 | 18.7117 |
| YM3 | CJ1 | 20.8123 | 21.5163 | 20.4943 | 21.1287 | 20.1269 | 19.7074 | 19.8193 | 21.814 |
| YM3 | CJ2 | 15.3831 | 15.3914 | 13.978 | 15.3736 | 17.8089 | 15.4067 | 16.8155 | 15.013 |
| YM3 | CJ3 | 15.8998 | 15.6293 | 15.8985 | 15.1017 | 13.9067 | 15.3893 | 12.671 | 17.2272 |
| YM3 | CJ4 | 14.3102 | 15.884 | 14.5913 | 15.9726 | 14.5617 | 14.6399 | 16.458 | 12.8065 |
| YM4 | CJ1 | 7.0095 | 8.1102 | 9.4122 | 7.9971 | 8.2916 | 8.8084 | 8.2669 | 9.2247 |
| YM4 | CJ2 | 10.078 | 8.6147 | 9.9562 | 10.1663 | 7.6405 | 10.138 | 9.5744 | 11.1569 |
| YM4 | CJ3 | 5.8856 | 6.0061 | 6.0244 | 6.1112 | 6.0119 | 6.0879 | 6.0697 | 5.8207 |
| YM4 | CJ4 | 16.5755 | 18.4011 | 20.05 | 17.5302 | 18.4007 | 17.4314 | 18.647 | 18.1716 |
| YM5 | CJ1 | 10.3845 | 5.927 | 7.4591 | 9.4055 | 7.147 | 8.9287 | 8.2887 | 8.0881 |
| YM5 | CJ2 | 13.5853 | 13.3751 | 13.2706 | 13.4288 | 14.3062 | 13.729 | we | 12.3742 |
| YM5 | CJ3 | 14.6742 | 13.3891 | 12.4956 | 12.1429 | 14.2665 | 11.6067 | 12.8831 | 13.7783 |
| YM5 | CJ4 | 10.5771 | 12.5106 | 10.8101 | 9.8395 | 10.3013 | 11.4359 | 11.7964 | 11.0032 |
| YM6 | CJ1 | 19.1383 | 17.8723 | 18.3309 | 17.9364 | 19.2695 | 19.9109 | 18.1695 | 21.5383 |
| YM6 | CJ2 | 19.8834 | 21.1933 | 21.2128 | 20.4289 | 19.8129 | 20.2798 | 19.4659 | 19.2077 |
| YM6 | CJ3 | 13.6914 | 13.9817 | 13.3845 | 15.1929 | 14.0173 | 13.698 | 12.9553 | 14.4908 |
| YM6 | CJ4 | 14.4155 | 13.5958 | 13.5507 | 14.6127 | 13.8933 | 14.6474 | 13.3814 | 13.37 |
| YM7 | CJ1 | 11.5405 | 12.2901 | 10.0116 | 11.9345 | 9.541 | 11.7174 | 12.2823 | 11.6964 |
| YM7 | CJ2 | 15.9246 | 14.9944 | 17.6234 | 15.5851 | 16.2213 | 18.7292 | 15.7262 | 16.9239 |
| YM7 | CJ3 | 11.3804 | 12.6096 | 12.5279 | 11.9913 | 11.5172 | 10.794 | 11.1202 | 12.1743 |
| YM7 | CJ4 | 18.7081 | 18.1852 | 18.8048 | 18.4292 | 16.7402 | 19.4369 | 18.7922 | 18.6377 |
| YM8 | CJ1 | 16.7742 | 15.8897 | 17.0262 | 16.0006 | 16.0669 | 16.1812 | 15.1061 | 17.5239 |
| YM8 | CJ2 | 9.038 | 8.0488 | 8.6015 | 8.8807 | 8.7028 | 8.742 | 8.9903 | 8.8041 |
| YM8 | CJ3 | 16.7219 | 18.1085 | 18.4131 | 18.7231 | 17.6136 | 18.2701 | 16.5918 | 17.0664 |
| YM8 | CJ4 | 17.4411 | 16.7789 | 17.181 | 16.574 | 16.7707 | 16.0488 | 17.9536 | 17.6768 |
| YM9 | CJ1 | 16.0437 | 13.7432 | 15.1446 | 14.3854 | 16.0945 | 13.7842 | 12.8237 | 15.3097 |
| YM9 | CJ2 | 11.1456 | 11.7702 | 11.5575 | 11.5211 | 11.0913 | 11.9126 | 11.3673 | 10.0932 |
| YM9 | CJ3 | 7.0878 | 7.1803 | 7.2164 | 7.248 | 7.0986 | 6.2319 | 6.9971 | 7.648 |
| YM9 | CJ4 | 8.9571 | 8.9731 | 8.55 | 9.4651 | 8.9002 | 9.393 | 8.8977 | 9.286 |
| YM10 | CJ1 | 13.3347 | 13.4041 | 13.3917 | 12.388 | 13.3082 | 12.9244 | 13.2299 | 12.9524 |
| YM10 | CJ2 | 7.3321 | 7.4947 | 6.7193 | 7.7555 | 7.5538 | 8.5793 | 7.3066 | 7.4354 |
| YM10 | CJ3 | 8.5679 | 9.3034 | 9.6899 | 8.9375 | 9.5718 | 9.1628 | 8.762 | 9.451 |
| YM10 | CJ4 | 15.9467 | 17.0119 | 15.6644 | 16.5498 | 15.8699 | 16.9276 | 16.1857 | 16.2099 |

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| 疫苗类型 The vaccine type | 生产工位Production location | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| YM1 | CJ1 | 11.8529 | 13.3252 | 12.7586 | 12.8351 | 10.7412 | 13.3426 | 13.7254 | 14.4897 |
| YM1 | CJ2 | 15.2916 | 15.8351 | 15.1049 | 14.9175 | 13.7859 | 15.3714 | 15.5525 | 14.2577 |
| YM1 | CJ3 | 19.1764 | 18.6663 | 19.738 | 18.8436 | 20.1001 | 20.7394 | 21.3546 | 18.0391 |
| YM1 | CJ4 | 20.6825 | 18.3235 | 19.6736 | 22.2905 | 19.9478 | 22.0271 | 18.3198 | 18.7018 |
| YM2 | CJ1 | 8.7493 | 10.0125 | 10.9337 | 9.9155 | 10.9492 | 9.0585 | 9.1243 | 9.7259 |
| YM2 | CJ2 | 20.5946 | 19.3096 | 18.0512 | 17.5137 | 20.2323 | 17.7416 | 19.41 | 18.7872 |
| YM2 | CJ3 | 16.7962 | 20.1778 | 17.7449 | 17.5191 | 18.4115 | 18.1006 | 17.8528 | 17.6174 |
| YM2 | CJ4 | 19.9594 | 19.9407 | 18.6886 | 17.3011 | 18.2159 | 19.5632 | 20.479 | 17.943 |
| YM3 | CJ1 | 19.7397 | 18.559 | 20.5455 | 19.9674 | 18.5169 | 19.71 | 19.3432 | 19.4592 |
| YM3 | CJ2 | 15.6925 | 16.3277 | 16.2748 | 15.2629 | 15.0179 | 16.2495 | 14.9201 | 16.4013 |
| YM3 | CJ3 | 15.07 | 13.9678 | 14.6999 | 14.787 | 15.1837 | 17.7873 | 14.5664 | 15.7512 |
| YM3 | CJ4 | 14.4229 | 15.5197 | 14.3333 | 15.1803 | 15.9835 | 14.4777 | 17.0034 | 15.7059 |
| YM4 | CJ1 | 8.6003 | 7.9625 | 6.827 | 8.7871 | 8.0226 | 8.9199 | 7.2223 | 8.213 |
| YM4 | CJ2 | 9.436 | 9.8391 | 11.3244 | 10.3105 | 10.9608 | 10.3763 | 9.49 | 9.2893 |
| YM4 | CJ3 | 5.7583 | 5.7971 | 5.95 | 6.1706 | 6.2094 | 5.7759 | 5.9177 | 5.9821 |
| YM4 | CJ4 | 17.2511 | 18.7276 | 18.7174 | 18.9297 | 18.1205 | 18.8864 | 18.0951 | 18.81 |
| YM5 | CJ1 | 8.8431 | 7.7374 | 8.9373 | 9.6263 | 8.7969 | 8.6362 | 8.7927 | 8.0617 |
| YM5 | CJ2 | 13.0258 | 13.5506 | 15.9122 | 12.8313 | 15.1473 | 14.214 | 12.8277 | 13.1 |
| YM5 | CJ3 | 12.3064 | 15.0108 | 13.125 | 11.844 | 13.1021 | 12.8301 | 12.7488 | 12.6138 |
| YM5 | CJ4 | 12.9151 | 11.2942 | 9.9469 | 11.164 | 9.9671 | 13.3774 | 11.8328 | 11.8967 |
| YM6 | CJ1 | 20.4099 | 20.0989 | 17.0929 | 19.0782 | 18.5997 | 19.553 | 16.4356 | 18.7603 |
| YM6 | CJ2 | 20.8542 | 20.7173 | 20.5531 | 21.6321 | 20.4855 | 19.7009 | 20.2917 | 20.0512 |
| YM6 | CJ3 | 14.2818 | 13.1016 | 14.4567 | 14.4608 | 15.3142 | 13.1972 | 14.8284 | 15.8136 |
| YM6 | CJ4 | 12.9235 | 14.2452 | 13.3452 | 13.2742 | 14.236 | 14.2894 | 13.3122 | 12.9656 |
| YM7 | CJ1 | 12.423 | 10.909 | 9.5551 | 12.3412 | 12.8179 | 12.0559 | 10.4183 | 13.2878 |
| YM7 | CJ2 | 15.6995 | 16.054 | 15.5268 | 16.434 | 17.0624 | 16.3585 | 18.7304 | 16.3036 |
| YM7 | CJ3 | 13.2816 | 10.2193 | 11.2798 | 12.7823 | 10.993 | 12.5066 | 11.7685 | 12.4331 |
| YM7 | CJ4 | 19.9276 | 18.8461 | 19.4584 | 18.4658 | 18.9495 | 19.4942 | 18.4356 | 20.1301 |
| YM8 | CJ1 | 15.061 | 15.049 | 16.2657 | 16.2775 | 15.2419 | 15.2438 | 14.3606 | 16.0543 |
| YM8 | CJ2 | 8.6296 | 8.8275 | 8.5406 | 8.8275 | 9.1803 | 8.758 | 8.7781 | 8.4575 |
| YM8 | CJ3 | 18.0825 | 18.1144 | 17.4154 | 17.6597 | 18.5017 | 17.1501 | 17.4949 | 17.3656 |
| YM8 | CJ4 | 14.7471 | 18.5081 | 16.7952 | 16.4648 | 17.6575 | 14.966 | 17.2623 | 18.1726 |
| YM9 | CJ1 | 16.8918 | 15.5654 | 15.8022 | 13.964 | 15.669 | 14.9864 | 15.3212 | 16.5908 |
| YM9 | CJ2 | 10.4482 | 11.2035 | 12.3573 | 11.1729 | 11.3709 | 10.5873 | 12.2406 | 11.6522 |
| YM9 | CJ3 | 7.0781 | 6.8336 | 6.954 | 6.374 | 6.7764 | 6.9978 | 7.6244 | 7.2502 |
| YM9 | CJ4 | 8.5309 | 9.8984 | 8.3148 | 8.5994 | 8.6044 | 8.9272 | 9.5176 | 8.9554 |
| YM10 | CJ1 | 13.0255 | 12.2419 | 13.3416 | 13.2895 | 13.6186 | 13.0593 | 13.432 | 13.4464 |
| YM10 | CJ2 | 6.5446 | 6.4157 | 6.6489 | 6.6556 | 6.2221 | 6.4314 | 7.4102 | 7.6133 |
| YM10 | CJ3 | 9.6746 | 9.3695 | 8.8117 | 9.8172 | 9.0476 | 8.7348 | 8.5426 | 9.6482 |
| YM10 | CJ4 | 16.0933 | 15.6887 | 15.8924 | 16.3889 | 16.2883 | 15.5722 | 15.8856 | 15.8614 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 疫苗类型 The vaccine type | 生产工位Production location | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| YM1 | CJ1 | 13.7172 | 12.6966 | 11.9311 | 12.2451 | 13.3192 | 13.6277 | 13.8622 | 16.5784 |
| YM1 | CJ2 | 14.8076 | 15.4882 | 15.1978 | 14.7563 | 15.7223 | 13.067 | 13.8865 | 14.7744 |
| YM1 | CJ3 | 21.379 | 19.7221 | 18.4229 | 21.1275 | 18.2498 | 19.4664 | 19.4555 | 21.7119 |
| YM1 | CJ4 | 17.8264 | 20.2755 | 18.7269 | 21.891 | 19.5453 | 20.7004 | 18.8028 | 19.6628 |
| YM2 | CJ1 | 11.2347 | 10.2761 | 9.052 | 6.9708 | 10.3503 | 11.6039 | 10.3071 | 9.8377 |
| YM2 | CJ2 | 21.0061 | 20.9248 | 20.3502 | 19.3484 | 21.0205 | 20.5812 | 20.4264 | 22.2294 |
| YM2 | CJ3 | 18.137 | 17.8232 | 17.7461 | 19.1385 | 18.1644 | 18.3275 | 18.677 | 18.8261 |
| YM2 | CJ4 | 18.1777 | 19.3501 | 18.6842 | 19.7873 | 18.43 | 19.6076 | 17.1946 | 19.1136 |
| YM3 | CJ1 | 20.0458 | 20.312 | 20.6001 | 20.4018 | 18.9484 | 21.636 | 18.9797 | 21.2616 |
| YM3 | CJ2 | 16.7989 | 16.7596 | 15.8682 | 15.7617 | 16.6011 | 14.2501 | 16.6125 | 15.007 |
| YM3 | CJ3 | 15.9019 | 14.9308 | 14.3914 | 16.3312 | 16.0294 | 14.1343 | 15.2908 | 13.8333 |
| YM3 | CJ4 | 15.0475 | 14.6666 | 15.144 | 14.9858 | 15.8641 | 15.5509 | 14.7023 | 15.1766 |
| YM4 | CJ1 | 8.6417 | 7.9564 | 6.6385 | 6.1037 | 6.2746 | 7.9978 | 7.9521 | 8.1498 |
| YM4 | CJ2 | 11.0486 | 10.053 | 10.5551 | 10.4093 | 9.7868 | 9.7505 | 11.7382 | 9.773 |
| YM4 | CJ3 | 6.0699 | 5.7593 | 5.9406 | 5.9573 | 5.6861 | 6.0809 | 5.9546 | 5.6935 |
| YM4 | CJ4 | 17.6464 | 17.9379 | 17.0637 | 17.2269 | 17.2221 | 16.3942 | 17.0101 | 16.6148 |
| YM5 | CJ1 | 9.0614 | 9.6527 | 9.2778 | 10.1104 | 9.4489 | 8.7133 | 8.5 | 8.4007 |
| YM5 | CJ2 | 15.2333 | 12.0352 | 12.8536 | 13.9157 | 13.6091 | 14.3926 | 14.5979 | 14.9424 |
| YM5 | CJ3 | 12.6798 | 11.5197 | 14.2815 | 13.0256 | 13.5301 | 13.0397 | 14.1963 | 12.8083 |
| YM5 | CJ4 | 10.3288 | 11.3656 | 11.6098 | 10.2222 | 11.6478 | 10.7172 | 10.6767 | 12.5261 |
| YM6 | CJ1 | 18.6477 | 17.6767 | 17.3375 | 19.1472 | 18.635 | 21.1066 | 18.3282 | 18.5766 |
| YM6 | CJ2 | 21.9278 | 19.047 | 21.3418 | 18.6951 | 19.0394 | 18.4678 | 21.026 | 19.1001 |
| YM6 | CJ3 | 13.6517 | 13.4139 | 15.1393 | 14.1562 | 13.7249 | 15.3623 | 12.5449 | 12.7344 |
| YM6 | CJ4 | 14.512 | 13.9531 | 15.0306 | 15.4725 | 13.7037 | 13.1335 | 13.1648 | 14.3953 |
| YM7 | CJ1 | 10.4174 | 10.8873 | 11.0063 | 10.7472 | 10.0323 | 10.4192 | 10.6256 | 11.1602 |
| YM7 | CJ2 | 16.2719 | 15.6787 | 15.5 | 16.163 | 18.1842 | 16.5201 | 16.2141 | 16.0362 |
| YM7 | CJ3 | 11.6792 | 11.7843 | 12.6201 | 9.6528 | 12.0407 | 14.4366 | 13.089 | 13.2033 |
| YM7 | CJ4 | 19.8967 | 19.0611 | 18.8898 | 18.7248 | 20.7553 | 19.2426 | 17.2442 | 19.9914 |
| YM8 | CJ1 | 16.0378 | 16.5458 | 14.2611 | 16.7948 | 15.7649 | 16.087 | 18.0783 | 16.4043 |
| YM8 | CJ2 | 9.1702 | 8.2577 | 8.4075 | 8.7539 | 8.0403 | 8.8833 | 8.8275 | 8.8363 |
| YM8 | CJ3 | 18.1412 | 17.7213 | 17.3961 | 18.1144 | 17.3806 | 17.0742 | 18.0831 | 17.2036 |
| YM8 | CJ4 | 15.585 | 17.6744 | 15.8316 | 16.1111 | 16.0222 | 16.738 | 17.5842 | 15.6714 |
| YM9 | CJ1 | 13.8043 | 14.458 | 13.7797 | 15.0778 | 14.5312 | 14.573 | 14.1512 | 15.4121 |
| YM9 | CJ2 | 10.9543 | 11.9596 | 12.8671 | 12.1354 | 14.7485 | 11.168 | 13.5338 | 12.975 |
| YM9 | CJ3 | 7.0373 | 6.9797 | 7.3555 | 6.9663 | 7.0274 | 6.9685 | 7.7906 | 7.4429 |
| YM9 | CJ4 | 9.1619 | 9.4194 | 8.4154 | 9.2957 | 8.816 | 8.7777 | 8.3937 | 8.9064 |
| YM10 | CJ1 | 12.8912 | 13.2607 | 12.7798 | 12.9658 | 12.5589 | 13.3814 | 13.5386 | 13.4797 |
| YM10 | CJ2 | 6.7361 | 6.2157 | 6.919 | 6.3879 | 7.2507 | 6.5716 | 7.5501 | 7.3215 |
| YM10 | CJ3 | 7.9742 | 9.0691 | 8.7758 | 9.45 | 9.394 | 8.6883 | 8.7864 | 9.0528 |
| YM10 | CJ4 | 15.8129 | 16.3005 | 16.4755 | 16.9602 | 16.2367 | 15.7255 | 14.9571 | 16.0038 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 疫苗类型 The vaccine type | 生产工位Production location | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| YM1 | CJ1 | 12.9369 | 14.409 | 14.6302 | 13.2939 | 12.1905 | 14.3703 | 13.3129 | 14.0933 |
| YM1 | CJ2 | 16.1006 | 13.9384 | 15.8886 | 14.8226 | 16.5877 | 15.2157 | 17.5855 | 14.561 |
| YM1 | CJ3 | 18.9278 | 19.8023 | 18.9418 | 20.7015 | 20.508 | 20.3502 | 19.7143 | 17.9974 |
| YM1 | CJ4 | 23.789 | 19.7352 | 20.5003 | 19.2858 | 19.4977 | 20.9902 | 20.0346 | 19.6854 |
| YM2 | CJ1 | 9.5162 | 11.5301 | 9.7704 | 9.7388 | 9.2589 | 9.543 | 9.971 | 10.0983 |
| YM2 | CJ2 | 19.7219 | 20.0662 | 19.3491 | 20 | 21.2503 | 21.1921 | 20.8617 | 17.8076 |
| YM2 | CJ3 | 19.0078 | 18.6487 | 17.7081 | 15.8679 | 16.5714 | 15.5031 | 18.7477 | 18.6647 |
| YM2 | CJ4 | 18.1392 | 18.7159 | 18.9058 | 17.1641 | 19.4286 | 18.1241 | 17.9743 | 18.8822 |
| YM3 | CJ1 | 18.5186 | 19.6914 | 19.9362 | 21.8045 | 20.5939 | 21.4702 | 20.3975 | 19.5749 |
| YM3 | CJ2 | 16.1992 | 16.9421 | 16.1202 | 15.3428 | 16.5954 | 16.2296 | 16.0923 | 16.9105 |
| YM3 | CJ3 | 14.8315 | 16.7783 | 13.1644 | 14.4927 | 13.7774 | 14.5811 | 14.6549 | 13.9569 |
| YM3 | CJ4 | 15.951 | 16.4158 | 16.7463 | 15.7135 | 13.3613 | 13.8445 | 15.1134 | 15.683 |
| YM4 | CJ1 | 8.5667 | 8.8797 | 8.4255 | 8.5824 | 8.3476 | 5.872 | 8.2882 | 8.0931 |
| YM4 | CJ2 | 8.6784 | 10.777 | 10.6607 | 8.7116 | 9.4432 | 9.0474 | 9.8655 | 10.5037 |
| YM4 | CJ3 | 5.9264 | 6.2042 | 5.8542 | 6.2076 | 5.3536 | 5.9349 | 5.9045 | 5.8599 |
| YM4 | CJ4 | 18.4967 | 18.1732 | 18.0464 | 19.199 | 16.7309 | 18.8366 | 18.316 | 18.6615 |
| YM5 | CJ1 | 9.2704 | 9.1614 | 7.1539 | 8.2657 | 9.6395 | 8.0104 | 8.6367 | 8.8027 |
| YM5 | CJ2 | 13.039 | 13.7143 | 14.6103 | 16.6052 | 14.5476 | 12.008 | 14.4092 | 15.3018 |
| YM5 | CJ3 | 12.7954 | 13.5256 | 13.8175 | 13.5404 | 12.1903 | 13.3083 | 12.0479 | 12.5494 |
| YM5 | CJ4 | 10.3054 | 11.5047 | 12.1867 | 14.5267 | 10.3521 | 9.9351 | 10.6824 | 12.1522 |
| YM6 | CJ1 | 19.4659 | 19.181 | 18.8252 | 19.1283 | 20.9437 | 21.2957 | 18.1519 | 18.2842 |
| YM6 | CJ2 | 20.9877 | 19.2255 | 19.8238 | 20.3539 | 17.5005 | 18.9941 | 18.3662 | 18.6631 |
| YM6 | CJ3 | 14.2177 | 14.9149 | 15.4126 | 14.7449 | 13.5741 | 15.5973 | 14.4431 | 14.4519 |
| YM6 | CJ4 | 14.3319 | 15.3396 | 14.0114 | 13.8839 | 14.3275 | 13.8839 | 12.5031 | 13.5782 |
| YM7 | CJ1 | 9.1699 | 11.1667 | 11.2226 | 10.9612 | 11.6865 | 12.1948 | 11.2021 | 11.8751 |
| YM7 | CJ2 | 15.7038 | 15.2097 | 17.4896 | 16.6611 | 16.7165 | 15.3673 | 16.8099 | 14.9078 |
| YM7 | CJ3 | 12.6134 | 11.9079 | 11.2156 | 11.8474 | 11.7133 | 10.2864 | 11.341 | 12.3024 |
| YM7 | CJ4 | 19.9015 | 19.1538 | 19.4123 | 19.2167 | 20.5724 | 19.2411 | 19.9315 | 18.8994 |
| YM8 | CJ1 | 13.5753 | 16.6878 | 15.6364 | 18.0099 | 16.017 | 16.0714 | 17.8773 | 16.1736 |
| YM8 | CJ2 | 8.3387 | 8.6464 | 8.5184 | 8.8277 | 7.9676 | 8.977 | 8.9818 | 9.2019 |
| YM8 | CJ3 | 18.4081 | 18.6298 | 19.2897 | 17.7995 | 17.6313 | 19.1469 | 18.5353 | 18.0053 |
| YM8 | CJ4 | 16.102 | 18.7351 | 16.9666 | 17.6784 | 18.202 | 16.0407 | 15.4271 | 15.9046 |
| YM9 | CJ1 | 15.0151 | 15.5265 | 15.3653 | 15.1223 | 14.6238 | 15.0807 | 14.9534 | 15.0777 |
| YM9 | CJ2 | 11.346 | 12.994 | 12.5057 | 12.6972 | 11.8546 | 12.4178 | 10.487 | 12.4979 |
| YM9 | CJ3 | 6.5214 | 7.3012 | 7.3741 | 6.6749 | 7.0277 | 7.0357 | 7.3006 | 6.6233 |
| YM9 | CJ4 | 9.1448 | 9.5184 | 9.1407 | 9.071 | 8.5023 | 8.1729 | 9.4364 | 8.4594 |
| YM10 | CJ1 | 12.2915 | 12.8179 | 13.3981 | 12.5045 | 12.5758 | 13.3912 | 12.2477 | 12.4089 |
| YM10 | CJ2 | 6.5912 | 8.1603 | 7.6208 | 6.0779 | 6.7555 | 5.9503 | 7.2702 | 7.0242 |
| YM10 | CJ3 | 9.0899 | 9.5496 | 8.7758 | 8.8108 | 9.0842 | 8.2344 | 9.1491 | 8.3249 |
| YM10 | CJ4 | 15.7376 | 16.5333 | 16.3477 | 15.663 | 15.6047 | 16.4806 | 16.6828 | 15.937 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 疫苗类型 The vaccine type | 生产工位Production location | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| YM1 | CJ1 | 13.3188 | 15.7694 | 13.7147 | 14.4172 | 13.4889 | 12.2127 | 10.0557 | 11.2885 |
| YM1 | CJ2 | 14.9932 | 16.1174 | 16.5442 | 17.3505 | 14.2352 | 14.8039 | 14.1955 | 13.8342 |
| YM1 | CJ3 | 20.3035 | 19.8059 | 20.961 | 18.7922 | 19.5314 | 17.9482 | 20.282 | 19.7009 |
| YM1 | CJ4 | 21.528 | 19.1165 | 22.4832 | 21.1871 | 20.587 | 21.293 | 20.8292 | 19.8982 |
| YM2 | CJ1 | 10.1352 | 9.8539 | 9.288 | 9.751 | 8.4938 | 10.4434 | 9.4922 | 11.2424 |
| YM2 | CJ2 | 19.6272 | 20.3376 | 20.4227 | 20.6524 | 20.2571 | 19.9451 | 20.9298 | 18.3882 |
| YM2 | CJ3 | 18.8577 | 18.5362 | 15.8763 | 18.8257 | 18.3018 | 19.1454 | 17.9791 | 18.4413 |
| YM2 | CJ4 | 20.8586 | 18.0953 | 19.7847 | 18.9133 | 19.3362 | 20.036 | 17.964 | 19.3199 |
| YM3 | CJ1 | 19.553 | 20.4754 | 20.1555 | 18.9034 | 20.6113 | 19.2769 | 17.814 | 19.6732 |
| YM3 | CJ2 | 15.9451 | 16.975 | 14.479 | 16.3005 | 16.5712 | 15.3961 | 17.0468 | 16.44 |
| YM3 | CJ3 | 15.1129 | 13.1457 | 14.7815 | 16.2231 | 15.0668 | 15.2358 | 15.3165 | 14.8597 |
| YM3 | CJ4 | 16.1437 | 15.9707 | 14.568 | 13.3955 | 15.1554 | 15.3174 | 14.2399 | 14.9905 |
| YM4 | CJ1 | 9.7013 | 9.4049 | 6.6174 | 10.0389 | 6.6853 | 6.9935 | 7.8182 | 6.8231 |
| YM4 | CJ2 | 9.5698 | 8.8511 | 9.3639 | 10.6224 | 12.5088 | 9.6288 | 9.1049 | 10.3173 |
| YM4 | CJ3 | 5.9675 | 5.7804 | 5.7278 | 5.8252 | 6.0654 | 5.8308 | 5.7826 | 6.3889 |
| YM4 | CJ4 | 19.1978 | 16.0432 | 19.0822 | 17.4945 | 17.2071 | 18.8017 | 18.498 | 16.8717 |
| YM5 | CJ1 | 9.383 | 8.4104 | 8.3472 | 8.7318 | 8.6017 | 9.5406 | 8.919 | 7.1712 |
| YM5 | CJ2 | 12.7187 | 14.0937 | 13.3463 | 13.5376 | 14.0591 | 14.9724 | 15.5651 | 14.8412 |
| YM5 | CJ3 | 13.1203 | 12.1342 | 10.7985 | 14.5233 | 13.4902 | 12.9085 | 11.7632 | 12.0618 |
| YM5 | CJ4 | 11.7665 | 11.1685 | 10.5381 | 10.5991 | 11.7907 | 10.8876 | 13.6173 | 9.2316 |
| YM6 | CJ1 | 19.5756 | 19.3616 | 20.8536 | 19.2442 | 18.5193 | 17.5576 | 17.9153 | 21.7526 |
| YM6 | CJ2 | 20.8707 | 20.6347 | 20.3929 | 20.7868 | 19.7562 | 21.597 | 19.8324 | 20.7907 |
| YM6 | CJ3 | 12.2577 | 13.8507 | 12.0908 | 13.9429 | 15.5024 | 13.1718 | 14.6361 | 14.1124 |
| YM6 | CJ4 | 12.724 | 13.1294 | 13.8839 | 13.0309 | 13.956 | 12.8533 | 14.6521 | 12.3667 |
| YM7 | CJ1 | 9.5483 | 11.2874 | 10.5509 | 8.8435 | 11.7795 | 11.0881 | 10.1451 | 11.6061 |
| YM7 | CJ2 | 16.8768 | 15.6354 | 16.5643 | 16.8034 | 17.4371 | 17.9153 | 17.3373 | 17.612 |
| YM7 | CJ3 | 13.7849 | 12.522 | 13.6829 | 11.7559 | 11.635 | 12.0337 | 12.598 | 11.7629 |
| YM7 | CJ4 | 18.7426 | 20.0771 | 19.3947 | 18.2414 | 19.5475 | 17.6019 | 19.5605 | 19.7547 |
| YM8 | CJ1 | 13.778 | 15.2061 | 15.7162 | 14.6066 | 16.1496 | 17.4167 | 16.2192 | 15.2263 |
| YM8 | CJ2 | 8.8466 | 9.2378 | 8.5702 | 8.8492 | 9.557 | 8.338 | 9.2825 | 8.7671 |
| YM8 | CJ3 | 18.1578 | 18.7253 | 19.0724 | 17.9208 | 17.5051 | 18.1367 | 17.1618 | 18.7873 |
| YM8 | CJ4 | 15.3835 | 16.6801 | 14.8427 | 16.6283 | 17.2611 | 16.6874 | 16.3393 | 16.5073 |
| YM9 | CJ1 | 14.9429 | 14.0629 | 13.8355 | 15.2648 | 17.4124 | 15.9623 | 15.0524 | 15.7947 |
| YM9 | CJ2 | 14.7335 | 12.2897 | 13.275 | 12.4284 | 12.332 | 12.1688 | 11.6138 | 12.8199 |
| YM9 | CJ3 | 7.2179 | 6.9258 | 6.9031 | 7.0854 | 7.2654 | 6.8246 | 7.9947 | 7.5825 |
| YM9 | CJ4 | 8.1086 | 8.5813 | 8.8948 | 9.7125 | 9.323 | 9.0613 | 8.938 | 8.5382 |
| YM10 | CJ1 | 12.9826 | 12.8295 | 13.1 | 12.5869 | 12.241 | 12.8734 | 12.8798 | 12.2896 |
| YM10 | CJ2 | 7.0875 | 6.9936 | 6.9368 | 7.2072 | 6.9212 | 7.1442 | 6.8886 | 6.8049 |
| YM10 | CJ3 | 9.2554 | 9.5642 | 8.5083 | 9.3266 | 8.2244 | 9.0715 | 8.4398 | 9.2523 |
| YM10 | CJ4 | 16.118 | 15.5312 | 16.5642 | 14.9504 | 16.4388 | 15.4524 | 15.7553 | 15.7211 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 疫苗类型 The vaccine type | 生产工位Production location | 49 | 50 | 平均 | 方差 | 最大值 | 最小值 | 极距 | statistic 正态分布 | pvalue |
| YM1 | CJ1 | 12.1351 | 14.1093 | 13.1222 | 0.974366 | 14.1093 | 12.1351 | 1.9742 | 0.983827 | 0.72025 |
| YM1 | CJ2 | 14.3331 | 13.2053 | 13.7692 | 0.317983 | 14.3331 | 13.2053 | 1.1278 | 0.978293 | 0.482443 |
| YM1 | CJ3 | 19.1686 | 20.9642 | 20.0664 | 0.806045 | 20.9642 | 19.1686 | 1.7956 | 0.983192 | 0.691952 |
| YM1 | CJ4 | 20.0769 | 20.9378 | 20.50735 | 0.185287 | 20.9378 | 20.0769 | 0.8609 | 0.991302 | 0.971692 |
| YM2 | CJ1 | 10.1825 | 10.0414 | 10.11195 | 0.004977 | 10.1825 | 10.0414 | 0.1411 | 0.963879 | 0.129222 |
| YM2 | CJ2 | 20.0012 | 17.6807 | 18.84095 | 1.34618 | 20.0012 | 17.6807 | 2.3205 | 0.959956 | 0.08852 |
| YM2 | CJ3 | 17.727 | 18.0852 | 17.9061 | 0.032077 | 18.0852 | 17.727 | 0.3582 | 0.980891 | 0.590097 |
| YM2 | CJ4 | 18.0913 | 19.6992 | 18.89525 | 0.646336 | 19.6992 | 18.0913 | 1.6079 | 0.980313 | 0.565225 |
| YM3 | CJ1 | 19.2481 | 20.5894 | 19.91875 | 0.449771 | 20.5894 | 19.2481 | 1.3413 | 0.9857 | 0.801241 |
| YM3 | CJ2 | 17.7298 | 16.8671 | 17.29845 | 0.186063 | 17.7298 | 16.8671 | 0.8627 | 0.984007 | 0.72821 |
| YM3 | CJ3 | 16.0128 | 14.7299 | 15.37135 | 0.411458 | 16.0128 | 14.7299 | 1.2829 | 0.984914 | 0.767918 |
| YM3 | CJ4 | 15.3984 | 16.1706 | 15.7845 | 0.149073 | 16.1706 | 15.3984 | 0.7722 | 0.985831 | 0.806681 |
| YM4 | CJ1 | 6.4058 | 7.6218 | 7.0138 | 0.369664 | 7.6218 | 6.4058 | 1.216 | 0.974828 | 0.359465 |
| YM4 | CJ2 | 8.8286 | 9.1073 | 8.96795 | 0.019418 | 9.1073 | 8.8286 | 0.2787 | 0.992045 | 0.981988 |
| YM4 | CJ3 | 5.7324 | 5.6739 | 5.70315 | 0.000856 | 5.7324 | 5.6739 | 0.0585 | 0.977069 | 0.436017 |
| YM4 | CJ4 | 19.4065 | 20.1385 | 19.7725 | 0.133956 | 20.1385 | 19.4065 | 0.732 | 0.978848 | 0.504452 |
| YM5 | CJ1 | 7.9794 | 9.4056 | 8.6925 | 0.508512 | 9.4056 | 7.9794 | 1.4262 | 0.955186 | 0.05592 |
| YM5 | CJ2 | 12.8576 | 13.4064 | 13.132 | 0.075295 | 13.4064 | 12.8576 | 0.5488 | 0.978081 | 0.474161 |
| YM5 | CJ3 | 13.854 | 13.1092 | 13.4816 | 0.138682 | 13.854 | 13.1092 | 0.7448 | 0.989957 | 0.945159 |
| YM5 | CJ4 | 12.769 | 9.8535 | 11.31125 | 2.125035 | 12.769 | 9.8535 | 2.9155 | 0.968645 | 0.203749 |
| YM6 | CJ1 | 18.2352 | 18.7195 | **18.4774** | 0.058637 | 18.7195 | 18.2352 | 0.4843 | 0.979102 | 0.514734 |
| YM6 | CJ2 | 20.7612 | 18.5262 | **19.6437** | 1.248806 | 20.7612 | 18.5262 | 2.235 | 0.977519 | 0.452746 |
| YM6 | CJ3 | 13.8652 | 15.6484 | **14.7568** | 0.794951 | 15.6484 | 13.8652 | 1.7832 | 0.979172 | 0.517596 |
| YM6 | CJ4 | 13.0952 | 13.0573 | **13.0763** | 0.000359 | 13.0952 | 13.0573 | 0.0379 | 0.991253 | 0.970911 |
| YM7 | CJ1 | 10.6521 | 12.3954 | 11.52375 | 0.759774 | 12.3954 | 10.6521 | 1.7433 | 0.987197 | 0.860339 |
| YM7 | CJ2 | 16.7163 | 15.7742 | 16.24525 | 0.221888 | 16.7163 | 15.7742 | 0.9421 | 0.971391 | 0.263431 |
| YM7 | CJ3 | 11.3695 | 12.0583 | 11.7139 | 0.118611 | 12.0583 | 11.3695 | 0.6888 | 0.976442 | 0.413496 |
| YM7 | CJ4 | 19.8253 | 17.375 | 18.60015 | 1.500993 | 19.8253 | 17.375 | 2.4503 | 0.96696 | 0.173631 |
| YM8 | CJ1 | 16.6092 | 16.4536 | 16.5314 | 0.006053 | 16.6092 | 16.4536 | 0.1556 | 0.97569 | 0.38761 |
| YM8 | CJ2 | 8.3874 | 9.5962 | 8.9918 | 0.365299 | 9.5962 | 8.3874 | 1.2088 | 0.980522 | 0.574157 |
| YM8 | CJ3 | 18.483 | 19.1391 | 18.81105 | 0.107617 | 19.1391 | 18.483 | 0.6561 | 0.986671 | 0.840392 |
| YM8 | CJ4 | 16.6297 | 17.5492 | 17.08945 | 0.21137 | 17.5492 | 16.6297 | 0.9195 | 0.982607 | 0.66587 |
| YM9 | CJ1 | 15.3535 | 16.7909 | 16.0722 | 0.51653 | 16.7909 | 15.3535 | 1.4374 | 0.979469 | 0.52979 |
| YM9 | CJ2 | 12.434 | 14.3156 | 13.3748 | 0.885105 | 14.3156 | 12.434 | 1.8816 | 0.969283 | 0.216386 |
| YM9 | CJ3 | 6.7242 | 6.7389 | 6.73155 | 5.4E-05 | 6.7389 | 6.7242 | 0.0147 | 0.990589 | 0.958932 |
| YM9 | CJ4 | 8.9344 | 9.1457 | 9.04005 | 0.011162 | 9.1457 | 8.9344 | 0.2113 | 0.981015 | 0.595498 |
| YM10 | CJ1 | 13.2166 | 13.2919 | 13.25425 | 0.001418 | 13.2919 | 13.2166 | 0.0753 | 0.96696 | 0.173631 |
| YM10 | CJ2 | 7.4954 | 6.6676 | 7.0815 | 0.171313 | 7.4954 | 6.6676 | 0.8278 | 0.980709 | 0.582222 |
| YM10 | CJ3 | 8.9181 | 8.4189 | 8.6685 | 0.0623 | 8.9181 | 8.4189 | 0.4992 | 0.977198 | 0.440792 |
| YM10 | CJ4 | 15.1811 | 16.1498 | 15.66545 | 0.234595 | 16.1498 | 15.1811 | 0.9687 | 0.980462 | 0.571615 |

附录19：第二题结果

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| 184.6549  4 5 10 7 8 1 2 3 6 9 |

附录20：第二题结果显示

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| 总时间:  184.6549  顺序：  4 5 10 7 8 1 2 3 6 9  编号 开始 结束  4 0.0000 41.9896  5 7.9887 55.9020  10 16.7587 71.9544  7 29.7409 91.0420  8 40.9011 107.8734  1 56.9212 127.8863  2 70.2052 146.8287  3 80.0761 161.9451  6 100.1345 175.7052  9 119.2086 184.6549 |

附录21：第三题结果

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| --- |
| 214.2449  204.8139  215.2513  213.4338  210.8892  219.1996  209.4289  210.8102  210.8892  210.8102  215.2513  210.8102  213.9206  216.2191  215.0129  213.5152  210.7944  210.8102  210.6963  215.0129  214.3142  213.4338  210.7944  210.8093  214.3142  210.8102  214.3142  214.3142  213.6408  206.0121  min:204.8139  4 10 7 8 2 6 1 3 5 9 |

附录22：第三题结果分箱分析

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| 0  1  4  3  6  9  23  11  12  10  8  7  2  3  1 |

附录23：第四题结果

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| 18113.7076  9084.5382  11178.5646  16419.4460  14408.6627  29622.5738  32017.9142  13423.6051  8069.5593  13721.7620  共 166060.3336 分钟 |

附录24：第五题lingo运行结果

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| LINGO/WIN64 19.0.24 (26 Oct 2020), LINDO API 13.0.4099.232  Licensee info: Eval Use Only  License expires: 17 FEB 2022  Global optimal solution found.  Objective value: 312228.3  Infeasibilities: 0.000000  Total solver iterations: 2  Elapsed runtime seconds: 0.13  Model Class: LP  Total variables: 10  Nonlinear variables: 0  Integer variables: 0  Total constraints: 25  Nonlinear constraints: 0  Total nonzeros: 70  Nonlinear nonzeros: 0  Variable Value Reduced Cost  X1 0.000000 9.819107  X2 500.0000 0.000000  X3 600.0000 0.000000  X4 0.000000 0.1268263  X5 1200.000 0.000000  X6 1546.861 0.000000  X7 492.0732 0.000000  X8 800.0000 0.000000  X9 600.0000 0.000000  X10 900.0000 0.000000  Row Slack or Surplus Dual Price  1 312228.3 1.000000  2 1000.000 0.000000  3 0.000000 7.500464  4 0.000000 1.408939  5 1000.000 0.000000  6 0.000000 11.64347  7 53.13886 0.000000  8 1307.927 0.000000  9 0.000000 2.848483  10 0.000000 14.27236  11 0.000000 4.241975  12 0.000000 0.000000  13 500.0000 0.000000  14 600.0000 0.000000  15 0.000000 0.000000  16 1200.000 0.000000  17 1546.861 0.000000  18 492.0732 0.000000  19 800.0000 0.000000  20 600.0000 0.000000  21 900.0000 0.000000  22 0.000000 0.9427237  23 281.6751 0.000000  24 7897.096 0.000000  25 0.000000 1.963532 |

附录25：第五题lingo代码

|  |
| --- |
| max 42x1+54x2+50x3+43x4+42x5+45x6+48x7+51x8+46x9+48x10  st  x1<=1000  x2<=500  x3<=600  x4<=1000  x5<=1200  x6<=1600  x7<=1800  x8<=800  x9<=600  x10<=900  x1>=0  x2>=0  x3>=0  x4>=0  x5>=0  x6>=0  x7>=0  x8>=0  x9>=0  x10>=0  13.2840x1+9.8709x2+20.0584x3+7.9887x4+8.7701x5+19.0741x6+11.1601x7+16.0201x8+15.0146x9+12.9822x10<=96000  14.9621x1+19.9075x2+15.9726x3+9.9366x4+13.7220x5+20.0944x6+16.4961x7+8.7289x8+12.0351x9+7.0110x10<=96000  19.8460x1+17.9282x2+14.9704x3+5.9359x4+13.0052x5+14.1485x6+12.0137x7+17.9794x8+7.0419x9+9.0492x10<=96000  20.0129x1+18.9424x2+15.1164x3+18.1284x4+11.2495x5+13.7601x6+19.0876x7+16.8314x8+8.9497x9+16.0524x10<=96000  end |

附录26：第五题线性规划结果

|  |
| --- |
| 线性规划结果：产量（剂） |
| 0 |
| 500 |
| 600 |
| 0 |
| 1200 |
| **1546** |
| **492** |
| 800 |
| 600 |
| 900 |
| 加粗的存在小数 |
|  |
| 每工位的多余时间 |
| 第 1 个工位剩余时间： 17.2175 |
| 第 2 个工位剩余时间： 300.2219 |
| 第 3 个工位剩余时间： 7910.1760 |
| 第 4 个工位剩余时间： 13.2403 |

附录27：第五题生产顺序安排。

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | 时间序列： | 结束当前工作的时间 | |  |  |  |  |  | |  | 初始 | 7个10号 | 1个2 | 1个3 | 1个7 | 490个(5,7) | 840个10 | 499个(2,3) | | 工位1 | 0 | 90.8754 | 100.7463 | 120.8047 | 131.9648 | 9897.7628 | 20802.8108 | 35737.5315 | | 工位2 | 12.9822 | 97.8864 | 120.6538 | 136.7773 | 153.2734 | 14960.1424 | 20849.3824 | 38753.5523 | | 工位3 | 19.9932 | 106.9356 | 138.582 | 153.5524 | 165.5661 | 14972.1561 | 22573.4841 | 38989.8855 | | 工位4 | 29.0424 | 141.4092 | 160.3516 | 175.468 | 194.5556 | 15059.7346 | 28543.7506 | 45539.0918 | |  |  | 浪费的时间 |  |  |  |  |  |  | | 工位1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 工位2 | 12.9822 | 48.8094 | 51.6693 | 51.8202 | 51.8202 | 51.8202 | 51.8202 | 51.8202 | | 工位3 | 19.9932 | 43.5912 | 57.3094 | 57.3094 | 57.3094 | 2604.6384 | 2604.6384 | 2604.6384 | | 工位4 | 29.0424 | 29.0424 | 29.0424 | 29.0424 | 29.0424 | 29.0424 | 29.0424 | 29.0424 | |  |  |  |  |  |  |  |  |  | |  | 100个3 | 600个(5,9) | 53个10 | 110个(5,8) | 550个(6,8) | 465个6 | 300个6 | 140个8 | | 工位1 | 37743.3715 | 52014.1915 | 52702.25 | 55429.17 | 74730.9801 | 83600.4366 | 89322.6666 | 91565.4806 | | 工位2 | 40350.8123 | 55805.0723 | 55875.18 | 58344.78 | 74197.5963 | 83541.4923 | 89569.8123 | 91574.2095 | | 工位3 | 40486.9255 | 55818.0775 | 55908.57 | 59316.88 | 76987.2205 | 83566.273 | 89583.9608 | 92101.0768 | | 工位4 | 47050.7318 | 59170.2518 | 59330.78 | 62419.67 | 79244.9998 | 85643.4463 | 89771.4763 | 92127.8723 | |  | 浪费的时间 |  |  |  | **做完后还剩996个6，140个8** | | **231,140** |  | | 工位1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 工位2 | 51.8202 | 51.8202 | 51.8202 | 51.8202 | 51.8202 | 51.8202 | 51.8202 | 834.1714 | | 工位3 | 2604.6384 | 5907.5304 | 5907.53 | 5907.53 | 5907.5304 | 5907.5304 | 7680.6682 | 7680.6682 | | 工位4 | 29.0424 | 29.0424 | 29.0424 | 29.0424 | 29.0424 | 29.0424 | 29.0424 | 29.0424 | |  |  |  |  |  | 550 | 465 | 300 | 140 | |  | 最后的6 |  |  |  |  |  |  |  | | 工位1 | 95723.6344 |  |  |  |  |  |  |  | | 工位2 | 95954.7887 |  |  |  |  |  |  |  | | 工位3 | 95968.9372 |  |  |  |  |  |  |  | | 工位4 | 95982.6973 |  |  |  |  |  |  |  | |  | 浪费的时间 |  |  |  |  |  |  |  | | 工位1 | 0 |  |  |  |  |  |  |  | | 工位2 | 834.1714 |  |  |  |  |  |  |  | | 工位3 | 8464.1556 |  |  |  |  |  |  |  | | 工位4 | 884.1656 |  |  |  |  |  |  |  | |  | 218 |  |  |  |  |  |  |  | |

附录28：第五题实际生产结果

|  |
| --- |
| 实际： |
| 0 |
| 500 |
| 600 |
| 0 |
| 1200 |
| 1533 |
| 491 |
| 800 |
| 600 |
| 900 |