

Team Number:	22XXXXXX
Problem Chosen:	A

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### 2023 APMCM summary sheet

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**Keywords:** Keywords1 Keywords2 Keywords3

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## **I. Introduction**

In order to indicate the origin of problems, the following background is worth mentioning.

**1.1**

**1.2**

**1.3**

## **II. The Description of the Problem**

**2.1 How do we approximate the whole course of ?**

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**2.2 How do we define the optimal configuration?**

- 1) From the perspective of :
- 2) From the perspective of the :
- 3) Compromise:

**2.3 The local optimization and the overall optimization**

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- Virtually:

## 2.4 The differences in weights and sizes of

## 2.5 What if there is no data available?

# III. Models

## 3.1 Basic Model

### 3.1.1 *Terms, Definitions and Symbols*

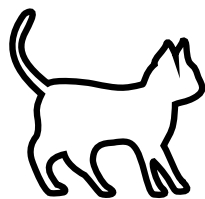
The signs and definitions are mostly generated from queuing theory.

### 3.1.2 *Assumptions*

### 3.1.3 *The Foundation of Model*

#### 1) The utility function

- The cost of :
- The loss of :
- The weight of each aspect:
- Compromise:



**Figure 1** 关注我们公众号，学习更多知识

#### 3) The overall optimization and the local optimization

- The overall optimization:
- The local optimization:
- The optimal number of :

### 3.1.4 *Solution and Result*

1) The solution of the integer programming: 2) Results:

### 3.1.5 *Analysis of the Result*

- Local optimization and overall optimization:
- Sensitivity: The result is quite sensitive to the change of the three parameters
- 
- Trend:
- Comparison:

### 3.1.6 *Strength and Weakness*

**Strength:** The Improved Model aims to make up for the neglect of . The result seems to declare that this model is more reasonable than the Basic Model and much more effective than the existing design.

**Weakness:** Thus the model is still an approximate on a large scale. This has doomed to limit the applications of it.

## IV. Conclusions

### 4.1 Conclusions of the problem

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### 4.2 Methods used in our models

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### 4.3 Applications of our models

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## V. Future Work

### 5.1 Another model

#### 5.1.1 *The limitations of queuing theory*

#### 5.1.2

#### 5.1.3

#### 5.1.4

## VI. References

- [1] Author, Title, Place of Publication: Press, Year of publication.
- [2] author, paper name, magazine name, volume number: starting and ending page number, year of publication.
- [3] author, resource title, web site, visit time (year, month, day).
- [4] L<sup>A</sup>T<sub>E</sub>X资源和技巧学习 <https://www.latexstudio.net>
- [5] L<sup>A</sup>T<sub>E</sub>X问题交流网站 <https://wenda.latexstudio.net>
- [6] 模板库维护 <https://github.com/latexstudio/APMCMThesis>

## VII. Appendix

Listing 1: The matlab Source code of Algorithm

```

kk=2; [mdd, ndd]=size(dd);
while ~isempty(V)
    [tmpd, j]=min(W(i, V)); tmpj=V(j);
    for k=2:ndd
        [tmp1, jj]=min(dd(1, k)+W(dd(2, k), V));
        tmp2=V(jj); tt(k-1, :)= [tmp1, tmp2, jj];
    end
    tmp=[tmpd, tmpj, j; tt]; [tmp3, tmp4]=min(tmp(:, 1));
    if tmp3==tmpd, ss(1:2, kk)=[i; tmp(tmp4, 2)];
    else, tmp5=find(ss(:, tmp4)~=0); tmp6=length(tmp5);
    if dd(2, tmp4)==ss(tmp6, tmp4)
        ss(1:tmp6+1, kk)=[ss(tmp5, tmp4); tmp(tmp4, 2)];
    else, ss(1:3, kk)=[i; dd(2, tmp4); tmp(tmp4, 2)];
    end; end
    dd=[dd, [tmp3; tmp(tmp4, 2)]]; V(tmp(tmp4, 3))=[];
    [mdd, ndd]=size(dd); kk=kk+1;
end; S=ss; D=dd(1, :);

```

Listing 2: The lingo source code

```

kk=2;
[mdd, ndd]=size(dd);
while ~isempty(V)
    [tmpd, j]=min(W(i, V)); tmpj=V(j);
    for k=2:ndd
        [tmp1, jj]=min(dd(1, k)+W(dd(2, k), V));
        tmp2=V(jj); tt(k-1, :)= [tmp1, tmp2, jj];
    end
    tmp=[tmpd, tmpj, j; tt]; [tmp3, tmp4]=min(tmp(:, 1));
    if tmp3==tmpd, ss(1:2, kk)=[i; tmp(tmp4, 2)];
    else, tmp5=find(ss(:, tmp4)~=0); tmp6=length(tmp5);
    if dd(2, tmp4)==ss(tmp6, tmp4)
        ss(1:tmp6+1, kk)=[ss(tmp5, tmp4); tmp(tmp4, 2)];
    else, ss(1:3, kk)=[i; dd(2, tmp4); tmp(tmp4, 2)];

```

```
end;  
end  
    dd=[dd,[tmp3;tmp(tmp4,2)]];V(tmp(tmp4,3))=[];  
    [mdd,ndd]=size(dd);  
    kk=kk+1;  
end;  
S=ss;  
D=dd(1,:);
```