For office use only	Team Control Number	For office use only
T1 _____	**55280**	F1 _____
T2 _____		F2 _____
T3 _____	Problem Chosen	F3 _____
T4 _____	**A**	F4 _____

2019
MCM/ICM
Summary Sheet

title

Summary

ABSTRACT

Keywords:

KEYWORD

title

January 22, 2019

Contents

1 Introduction **2**

1.1 Problem Background 2

1.2 Our Work 2

2 Assumptions **2**

3 Nomenclature **2**

4 Statement of our Model **2**

4.1 part1 2

4.2 part2 2

4.3 part3 2

5 Implementation **2**

6 Strategies **3**

7 Model Analysis **3**

7.1 Sensitivity Analysis 3

7.2 Strengths and Weaknesses 3

7.2.1 Strengths 3

7.2.2 Weaknesses 3

8 Conclusion **3**

MEMORANDUM **4**

Option 1: 4

Option 2: 4

Appendices **6**

Appendix A Implemented Genetic Algorithm **6**

Appendix B Fitness Function **6**

1 Introduction

1.1 Problem Background

BACKGROUND

1.2 Our Work

OURWORK

2 Assumptions

First and foremost, we make some basic assumptions and explain their rationales.

1. ASSUMPTION 1
2. ASSUMPTION 2
3. ASSUMPTION 3

3 Nomenclature

In this paper we use the nomenclature in Table 1 to descibe our model. Other symbols that are used only once will be described later.

4 Statement of our Model

In this section, we will discuss all details about our model. This model takes several fields into consideration, ranging from liquid flow theory to economy. To begin with, we first investigate the behavior of water flow. Then we provide our integrated model of dams in series. This model makes a great balance between safety and costs.

4.1 part1

4.2 part2

4.3 part3

5 Implementation

IMPLEMENTATION

Table 1: Nomenclature

Symbol	Definition
i	the ith dam in a series of small dams
X_i	Distance from the river's beginning to dam i
$Series(X)$	Value of safety evaluation under a series of dams

6 Strategies

7 Model Analysis

7.1 Sensitivity Analysis

7.2 Strengths and Weaknesses

7.2.1 Strengths

1. advantage1
2. advantage2
3. advantage3

7.2.2 Weaknesses

1. weakness1
2. weakness2
3. weakness3

8 Conclusion

MEMORANDUM

Option 1:

one

two

three

Option 2:

one

two

three

References

[1] "Kariba dam," Wikipedia. [Online]. Available: https://en.wikipedia.org/wiki/Kariba_Dam

[2] "Kariba dam-case study," World Commission on Dams, 2010. [Online]. Available: http://202.120.0.1/cache/1/03/nanjing-school.com/897d9a2a02069bb2075b729dd8c33afb/World_Commission_on_Dams_2000_Case_Study_Kariba_Dam_Final_Report_November_2000-2etc5lv.pdf

[3] "Manning formula," Wikipedia. [Online]. Available: https://en.wikipedia.org/wiki/Manning_formula

[4] "Determination of reservoir storage capacity," Education. [Online]. Available: http://www.slideshare.net/chingtonymbuma/determination-of-reservoir-storage-capacity

[5] Z. W.-y. YANG Qiang, WU Hao, "Stress evaluation in finite element analysis of dams," *Engineering Mechanics(In Chinese)*, vol. 23(1), pp. 69–73, 2006.

[6] "Hydropower," Wikipedia. [Online]. Available: https://en.wikipedia.org/wiki/Hydropower

[7] "The zambezi river basin : A multi-sector investment opportunities analysis - basin development scenarios," World Bank, 2010. [Online]. Available: https://openknowledge.worldbank.org/handle/10986/2959

[8] J. G. Jay R. Lund, "Some derived operating rules for reservoirs in series or in parallel," *Journal of Water Resources Planning and Management*, vol. 125(3), pp. 143–153, 1999.

[9] J.Kelman and J.P.DAMAZIO, "The determination of flood control volumes in a multireservoir system," *Journal of Water Resources Planning and Management*, vol. 25(3), pp. 337–344, 1989.

[10] J. Vail, F. Ferrante, and J. Mitman, "Generic failure rate evaluation for jocassee dam," UNITED STATES NUCLEAR REGULATORY COMMISSION, 2010. [Online]. Available: https://www.nrc.gov/docs/ML1303/ML13039A084.pdf

[11] "Bathtub curve," Wikipedia. [Online]. Available: https://en.wikipedia.org/wiki/Bathtub_curve

[12] J. Leslie, "One of africa's biggest dams is falling apart," The New Yorker, 2016. [Online]. Available: http://www.newyorker.com/tech/elements/one-of-africas-biggest-dams-is-falling-apart

[13] "Zambia, zimbabwe to start kariba dam repairs in early 2017," REUTERS AFRICA, 2016. [Online]. Available: http://af.reuters.com/article/zambiaNews/idAFL5N17T1OI

[14] N. G. Mankiw, *Principles of macroeconomics*. Cengage Learning, 2014.

Appendices

Appendix A Implemented Genetic Algorithm

```
n=13;% need adjust
B_sub1=[zeros(n,1);0.00001];
%B_sub1 means the VLB of the Xi
B_sub2=[ones(n,1)*2100;0.1];
%B_sub2 means the VUB of the Xi
B=[B_sub1,B_sub2];
% constraint of Xi
initPop=initializega(n,B,'fitness');
[x endPop,bPop,trace]=ga(B,'fitness',[],initPop,[1e-6 1 1],
    'maxGenTerm',10000,'normGeomSelect',...
    [0.08],['arithXover'],[2],'nonUnifMutation',[2 10000 3]);
%3000 generations
xx=sort(x(1:14));
% sites selection sorts as ascending order
x=[xx,x(15)];
% the last one is the evaluation value
```

Appendix B Fitness Function

```
function[sol,eval]=fitness(sol,~)
n=13;
x=sol(1,1:n+1);
xx=sort(x(1:n));
x=[xx,x(n+1)];
p1=0;
p2=0;
cc=0;
N=50;
Ca=300;
BB=6000;
aa1=400;
rr=0.8;
pp=1005;
yy=0.5;
l=200;
Cmin=2e6;
Pm=1e8;
% above are the constant parameter setting
wei=[0.12,0.54,0.34];
% wei means the weight of three key function
for i=1:n
    k=my(x(i));
    Q=my2(x(i));
    R=(1-(1-x(n+1))^N)*Q*aa1*(1+rr);
    C=((Ca/n)*k+BB)*(1/(x(n+1))^1.1);
    Power=Q*pp*yy*k*l*9.8/1000;
    p1=p1+Power;
    p2=p2+C+R;
end
p1=p1/Pm
p2=Cmin/p2
for j=1:n-1
    cc=cc+((x(n)-x(1))/(n-1)-(x(j+1)-x(j)))^2;
end
    Sa=((x(n)-x(1))/exp(cc/((x(n)-x(1))/(n-1))^2))/2100
    eval=p1*wei(1)+Sa*wei(3)+p2*wei(2)
end
```