Management Science

Assignment no 3

Beniesuja – F19079

2019

**INTEGER PROGRAMMING**

**PENTAGONAL PICTURES**

# DECISION VARIABLES:

Let

i=1,2, 3…,10 be the choice of movie.

j=1,2 be the type of star chosen for the movie (No name cast or Big star). Xij=denotes the selected movie

Pij=Profit earned by the movie Xij.

Cij=Cost of production incurred by the movie Xij. Aij=Advertisement cost for the movie Xij.

### OBJECTIVE FUNCTION:

MAX Z=∑ 0.8 XijPij - XijCij - Xij Aij

### CONSTRAINTS:

1. **∑ Xij Aij<=15** (Cost of advertisements shouldn’t exceed 15 million)
2. **∑ Xij Cij<=100** (Cost of Production shouldn’t exceed 100 million)
3. **∑ (X1j, X3j, X4j, X5j, X6j, X8j)>= (∑ Xij)/2** (At least half the films produced must have a rating of PG or PG-13)
4. **∑ (X4j, X6j, X7j, X8j)>=2** (At least two comedy movies are produced)
5. **∑ (X9j, X10j)>=1** (if the crash is produced bombs away will not be)
6. **∑ (X2j, X3j, X5j)>=1** (At least one drama is to be produced)
7. **∑ (Xi2)>=2** (At least two films should have big name casts)
8. **∑ (X3j, X4j, X6j, X8j)>=2** (At least two PG films should be produced)
9. **∑ (X12, X92, X102)>=1** (At least one action movie with Big name cast to be produced)
10. **∑ (X1j) = 1, ∑ (X2j) =1……∑ (X10j) =1** (To avoid repeated selection) 11.**Xij =1** (To make it an integer)

# EXCEL FORMULATION:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **No Name cast** | | | | **Big star cast** | | | |  |
| **Movie Name** | **Rating** | **Type** | **Profit** | **Cost** | **Selection** | **Ad** | **Profit** | **Cost** | **Selection** | **Ads Cost** | **Sum of selection** |
| **Two-Edged Sword** | PG-13 | Action | 8 | 5 | 0 | 1 | 15 | 10 | 0 | 3 | 0 |
| **Lady in waiting** | R | Drama | 20 | 12 | 1 | 1 | 35 | 25 | 0 | 3 | 1 |
| **Yesterday** | PG | Drama | 10 | 8 | 0 | 1 | 26 | 12 | 1 | 3 | 1 |
| **Golly Gee** | PG | Comedy | 12 | 7 | 1 | 1 | 26 | 15 | 0 | 3 | 1 |
| **Why I Cry** | PG-13 | Drama | 30 | 15 | 1 | 1 | 45 | 30 | 0 | 3 | 1 |
| **Captain Kid** | PG | Comedy | 20 | 10 | 1 | 1 | 28 | 17 | 0 | 3 | 1 |
| **Oh Yes!** | R | Comedy | 7 | 4 | 1 | 1 | 12 | 8 | 0 | 3 | 1 |
| **Nitty Gritty** | PG | Comedy | 15 | 11 | 0 | 1 | 20 | 14 | 0 | 3 | 0 |
| **The Crash** | R | Action | 28 | 20 | 0 | 1 | 65 | 40 | 1 | 3 | 1 |
| **Bombs away** | R | Action | 37 | 25 | 0 | 1 | 80 | 50 | 0 | 3 | 0 |
| **Total** | | | **89** | **48** | **5** | **5** | **91** | **52** | **2** | **6** |  |

#### \*all the data are in millions

#### Constraints:

|  |  |  |
| --- | --- | --- |
| **Description** |  | **Result** |
| Cost of advertisements (shouldn’t exceed 15 million) |  | 11 million |
| Cost of Production (shouldn’t exceed 100 million |  | 100 million |
| No. of movies produced |  | 7 |
| At least half the films produced must have a rating of PG or PG-13 |  | 4 |
| At least two comedy movies are produced |  | 3 |
| if the crash is produced bombs away will not be |  | 1 |
| At least one drama is to be produced |  | 3 |
| At least two films should have big name casts |  | 2 |
| At least two PG films should be produced |  | 3 |
| At least one action movie with Big name cast to be produced |  | 1 |
| **Gross Profit** |  | 180 |
| **80% of Gross Profit** |  | 144 |
| **Max Profit Possible** |  | 33 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cell** | **Name** | **Cell Value** | **Formula** | **Status** | **Slack** |
| $K$7 | if the crash is produced bombs away will not be Solver answer | 1 | $K$7<=1 | Binding | 0 |
| $K$3 | Cost of Production shouldn’t exceed 100 million Solver answer | 100 | $K$3<=100 | Binding | 0 |
| $K$6 | At least two comedy movies are produced Solver answer | 3 | $K$6>=2 | Not Binding | 1 |
| $K$5 | At least half the films produced must have a rating of PG or PG-13 Solver answer | 4 | $K$5>=$O$6 | Not Binding | 0.5 |
| $K$2 | Cost of advertisements shouldn’t exceed 15 million Solver answer | 11 | $K$2<=15 | Not Binding | 4 |
| $J$11 | Total Selection | 2 | $J$11>=2 | Binding | 0 |
| $K$8 | At least one drama is to be produced Solver answer | 3 | $K$8>=1 | Not Binding | 2 |
| $K$10 | At least two PG films should be produced Solver answer | 3 | $K$10>=2 | Not Binding | 1 |
| $K$11 | At least one action movie with Big name cast to be produced Solver answer | 1 | $K$11>=1 | Binding | 0 |
| $F$3:$F$12=Binary |  |  |  |  |  |
| $J$3:$J$12=Binary |  |  |  |  |  |

**VARIOUS SCENARIOS**

When the following constraints were removed one by one and solved, the solution obtained was as same as the initial one (i.e.) when all the constraints were considered.

1. **∑ (Xi2)>=2** (At least two films should have big name casts)
2. **∑ (X3j, X4j, X6j, X8j)>=2** (At least two PG films should be produced)
3. **∑ (X12, X92, X102)>=1** (At least one action movie with Big name cast to be produced)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **No Name cast** | | | | **Big star cast** | | | |  |
| **Movie Name** | **Rating** | **Type** | **Profit** | **Cost** | **Selection** | **Ad** | **Profit** | **Cost** | **Selection** | **Ads Cost** | **Sum of selection** |
| **Two-Edged Sword** | PG-13 | Action | 8 | 5 | 0 | 1 | 15 | 10 | 0 | 3 | 0 |
| **Lady in waiting** | R | Drama | 20 | 12 | 1 | 1 | 35 | 25 | 0 | 3 | 1 |
| **Yesterday** | PG | Drama | 10 | 8 | 0 | 1 | 26 | 12 | 1 | 3 | 1 |
| **Golly Gee** | PG | Comedy | 12 | 7 | 1 | 1 | 26 | 15 | 0 | 3 | 1 |
| **Why I Cry** | PG-13 | Drama | 30 | 15 | 1 | 1 | 45 | 30 | 0 | 3 | 1 |
| **Captain Kid** | PG | Comedy | 20 | 10 | 1 | 1 | 28 | 17 | 0 | 3 | 1 |
| **Oh Yes!** | R | Comedy | 7 | 4 | 1 | 1 | 12 | 8 | 0 | 3 | 1 |
| **Nitty Gritty** | PG | Comedy | 15 | 11 | 0 | 1 | 20 | 14 | 0 | 3 | 0 |
| **The Crash** | R | Action | 28 | 20 | 0 | 1 | 65 | 40 | 1 | 3 | 1 |
| **Bombs away** | R | Action | 37 | 25 | 0 | 1 | 80 | 50 | 0 | 3 | 0 |
| **Total** | | | **89** | **48** | **5** | **5** | **91** | **52** | **2** | **6** |  |

#### \*all the data are in millions

#### Constraints:

|  |  |
| --- | --- |
| **Description** | **Result** |
| Cost of advertisements shouldn’t exceed 15 million | 11 |
| Cost of Production shouldn’t exceed 100 million | 100 |
| No. of movies produced | 7 |
| At least half the films produced must have a rating of PG or PG-13 | 4 |
| At least two comedy movies are produced | 3 |
| if the crash is produced bombs away will not be | 1 |
| At least one drama is to be produced | 3 |
| **Gross Profit** | 180 |
| **80% of Gross Profit** | 144 |
| **Max Profit Possible** | 33 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cell** | **Name** | **Cell Value** | **Formula** | **Status** | **Slack** |
| $K$8 | At least one drama is to be produced Solver answer | 3 | $K$8>=1 | Not Binding | 2 |
| $K2 | Cost of advertisements shouldn’t exceed 15 million Solver answer | 11 | $K$2<=15 | Not Binding | 4 |
| $K$6 | At least two comedy movies are produced Solver answer | 3 | $K$6>=2 | Not Binding | 1 |
| $K$3 | Cost of Production shouldn’t exceed 100 million Solver answer | 100 | $K$3<=100 | Binding | 0 |
| $K$7 | if the crash is produced bombs away will not be Solver answer | 1 | $K$7<=1 | Binding | 0 |
| $K$5 | At least half the films produced must have a rating of PG or PG-13 Solver answer | 4 | $K$5>=$O$6 | Not Binding | 0.5 |
| $J$3:$J$12=Binary |  |  |  |  |  |
| $F$3:$F$12=Binary |  |  |  |  |  |