

## **Project management using Excel spreadsheets: The case of Jules Event Planning Company**

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### **ABSTRACT**

The Jules Event Planning Company case illustrates how the application of network or precedence diagram can be used in project management. It shows the students how to depict major project activities and their sequential relationships. Students completing the Jules Event Planning Company case will be able to construct Gantt chart using Excel spreadsheet. It also enriches students' knowledge on how to apply linear programming in crashing a project. The linear programming model presented in this case will illustrate how Excel Solver can be used in project management time-cost trade off (crashing). It will help students decide on how much to crash each activity so that the deadline of the project is met at a minimum cost.

**Keywords:** Linear programming, Project management, Gantt chart, Network models, Crashing



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## INTRODUCTION

Project management is the discipline of planning, organizing, and controlling resources to achieve specific goals. It includes developing a project plan, which comprises defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved, quantifying the resources needed, and determining budgets and timelines for completion. A project is a temporary effort with a defined beginning and end (usually time-constrained, and often constrained by funding or deliverables), undertaken to meet unique goals and objectives. The primary challenge of project management is to achieve all of the project goals and objectives while honoring the defined constraints. The primary constraints are scope, time, quality and budget. The secondary and more ambitious challenge is to optimize the allocation of necessary inputs and integrate them “to meet pre-defined objectives. A successful Project Manager must simultaneously manage the four basic elements of a project: resources, time, money, and most importantly, scope. All these elements are interrelated. Each must be managed effectively. All must be managed together if the project, and the project manager, is to be a success”.

Gantt charts have become a common technique for representing the phases and activities of a project work breakdown structure, so they can be understood by a wide audience all over the world. Gantt chart is a type of bar chart developed by Henry Gantt between the years 1910-1915. Once Gantt chart completed, the chart indicates which activities to occur, their planned duration, and when they were to occur. It enables managers to initially schedule project activities and then monitor progress over time by comparing planned progress to actual progress.

The project manager most of the time “is confronted with having to reduce the scheduled completion time of a project to meet a deadline. Project duration can often be reduced by assigning more labor to project activities, in the form of over time, and by assigning more resources, such as material, equipment, etc. However, the additional labor and resources increase the project cost. So, the decision to reduce the project duration must be based on an analysis of the time- cost tradeoff (crashing). Project crashing is a method for shortening the project duration by reducing the time of one or more of the critical project activities to less than its normal activity time. The objective of crashing is to reduce project duration while minimizing the cost of crashing to meet the project deadline” (6).

Linear programming can be used to construct one of the most popular optimization models for project scheduling (crashing). “Linear programming is a problem-solving approach developed to help managers make decisions. It is a powerful tool used by operations managers and other managers to obtain optimal solutions to problems that involve restrictions or limitations on their resources. These problems are referred to as constrained optimization problems” (1). The linear programming model presented in this case will illustrate how Excel Solver can be used in project management time-cost trade off (crashing). It will help managers decide on how much to crash each activity so that the deadline of the project is met at a minimum cost.

## LEARNING OBJECTIVES

1. To use network diagrams to represent the problem graphically.
2. To draw Gantt chart using Excel spreadsheet.
3. To compute the time and cost required to complete the project and to recognize the critical activities.

4. To use linear programming Solver model to decide how much to crash each activity in order to meet the deadline at a minimum cost.

## OVERVIEW

Welcome to Jules Events planning company. Jules Events Planning Company plan and organizes your corporate events, wedding, birthdays, anniversaries, showers, or any other special occasion that requires a professional touch to ensure things go just the way you planned. Jules Events Planning Company is a professional event management firm that addresses your concerns in planning and organizing functions in order to execute with the finest details to meet your level of satisfaction. Jules Managers ensure the event is designed to make you happy from start to finish. Jules management team provides a variety of styles, trends, creative ideas to ensure your event suits your liking. The two primary event planners, Cindy and Donna, have over ten years of experience and have received outstanding reviews from customers.

Jules Events' goals are to provide clients with a stress free, consistent, and professionally facilitated event that accurately fulfills the client's wishes and is enjoyable for guests and hosts alike. Jules Events provides a financial framework that is workable for budgets of various sizes. Jules Events will strive to support other businesses and community organizations by providing revenues and resources with-in your community when available. Jules managers strive to be the best event planning specialists in the Midwest.

Jules Events offers two types of services: an all-inclusive event package and a day of event package. The all-inclusive package includes planning the special event from day one until the end of the event. The day of event package is tailored to event hosts who will plan their entire event on their own but would like a professional on-site to direct the day. John and Emily were recently engaged and are looking for event planners for their big day.

John and Emily chose Jules Events to plan their wedding day. John and Emily met with Cindy to schedule their initial wedding planning appointment on January 12<sup>th</sup>. Cindy met with them and began to explain to John and Emily that their wedding day project will consist of 18 activities, labeled A through R, as listed in Table 1 (Appendix). This table indicates the immediate predecessor along with each activity's expected duration.

Assume that you are hired as an intern at Jules Event planning company. Your role is to assist Cindy to manage her project efficiently. Cindy requesting your help to do the following:

- 1) Draw the precedence network diagram for this project.
- 2) Draw Gantt chart using Microsoft Excel
- 3) Determine the critical path and expected time to complete the project.
- 4) Calculate the project cost

John called Cindy to know about the expected time to complete his wedding project. He was surprised that it would take more time than what he anticipated. He wanted to Surprise his fiancée Emily and plan the wedding to be on her birthday on April 10. He asked Cindy to expedite the project if she can. Cindy can crash some of the activities using the help of Donna which will cost more money. Cindy developed Table 2 (Appendix) to incorporate the time to crash some activities and the cost involved to crash tem. Table 2 represents Cindy's proposal.

- 5) Develop a Solver model to decide on how much to crash each activity so that the deadline of April 10 is met at a minimum cost.

**Teaching Notes (solution to case requirements)**

Requirement 1: Draw the precedence network diagram for this project.

*Requirement 1 solution:* Figure 1 (Appendix) represents the network diagram for John and Emily's wedding project

Requirement 2: Draw Gantt chart using Microsoft Excel.

*Requirement 2 solution:* The stacked bar chart from Excel chart wizard can be used to create Gantt chart using Excel spreadsheet. Three pieces of information are needed to draw the Gantt chart, the name of the activities, their start times, and their durations as shown in Figure 2 (Appendix).

The following steps are helpful in drawing the Gantt chart. Highlight the data in the three columns range, go to insert chart wizard, and choose the horizontal stacked bar chart (the second sub type in the bar chart category). The resulting chart will have two adjacent bars for each activity, one for the start time and the other for the duration. To get the correct drawing for the Gantt chart, right click on one of the start time bars and select format data series. Then change the border color to none and the fill to no fill. This step will hide the start time bars and shows only the properly placed duration's bars. Figure 3 (Appendix) exhibits the Gantt chart for John and Emily's wedding project.

Requirement 3: Determine the critical path and expected time to complete the project.

*Requirement 3 solution:* To determine the length of the critical path, planners need to determine four pieces of information. The earliest start time for each activity assuming all preceding activities start as early as possible, the earliest finish time, the latest time the activity can start and not delay the project, the latest finish time without delaying the project. The activity slack time can be determined by calculating the difference between the latest finish and earliest finish time or the difference between latest start and earliest start time. Critical activities have a slack of zero which means that their earliest start time and their latest start time are the same. Critical activities cannot be delayed, otherwise the whole project will be delayed. Table 3 (Appendix) presents the earliest start, the earliest finish, the latest start, the latest finish, and the slack for each activity.

The critical path consists of all activities that are critical. The critical path follows this sequence as shown in Figure 4 (appendix). The expected time to complete the project is 123 days.

A → B → C → D → E → F → I → J → L → M → N → O → P → Q → R

Requirement 4: Calculate the project cost.

*Requirement 4 solution:* The cost for the project is \$6850. Figure 5 (Appendix) presents the cost calculations for John and Emily's wedding project.

Requirement 5: Develop a Solver model to decide on how much to crash each activity so that the deadline of April 10 is met at a minimum cost.

*Requirement 5 solution:* John knows that if his wedding project's activities continue to take long time as their original schedule, the entire project will take 123 days and he cannot meet the deadline of April 10. There are 88 more days until April 10. Cindy and Donna wanted to help John surprise his Fiancée and meet the deadline by crashing some of the critical activities. Figure 6 (Appendix) exhibits the Excel Solver model to meet the deadline. Figure 7(Appendix) shows the linear programming Excel Solver parameters. As shown in Figure 5, Cindy and Donna were

able to meet the deadline and complete the project in 88 days by incurring an additional cost of \$2320. According to Excel Solver solution, activities C, D, E, F, I, J, L, N and P needed to be crashed by the following amount 1, 8, 6, 10, 4, 3, 1, 1, and 1 respectively.

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**APPENDIX**

Table 1. Data for John and Emily's Wedding Project

Description	Activity	Immediate Predecessor	Duration (Days)	Cost per day (Dollars)
Create an overall timeline and perform budget analysis	A	-	1	100
Assistance in shopping for event attire	B	A	14	50
Assistance in selecting all paper products (save-the-dates, invitations, programs, etc.)	C	B	7	55
Recommend vendors	D	C	21	60
Schedule and accompany to any and all vendor appointments including site inspections, initial consultations, taste testing's etc. (as needed)	E	D	18	50
Assist in finding and securing ceremony and reception sites	F	E	30	40
Assist with menu selection and ordering	G	F	1	80
Review contracts	H	G	1	80
Assist with planning music	I	F	10	60
Coordinate and direct rehearsal	J	I	5	25
Coordinate and schedule all hair and make-up rehearsal appointments for event hosts	K	F	7	30
Coordinate event party transportation, dressing areas, etc	L	J,K	5	35
Ensure all details of the event day are in place and everyone directly involved is educated on and comfortable with their roles and responsibilities	M	H,L	2	70
Ensure that event hosts to provide: copies of all vendor contracts, details of event plants, event day time-line, schedule of events, complete detail list of event	N	M	4	75
Meet with John and Emily to discuss any last minute changes, review the event day time-line, go over details of event as well as set-up/breakdown,	O	N	1	100
Create final draft of timelines, schedules, seating charts, etc as needed and distribute to appropriate people	P	O	3	90
Direct Event Rehearsal	Q	P	1	100
Event Day Onsite <ul style="list-style-type: none"> <li>○ Oversee set up</li> <li>○ Direct ceremony</li> <li>○ Act as liaison between all vendors</li> </ul>	R	Q	1	125

Table 2: Crashing input

Description	Activity	Cost per day (Dollars)	Maximum Reduction ( Days)
Create an overall timeline and perform budget analysis	A	0	0
Assistance in shopping for event attire	B	70	2
Assistance in selecting all paper products (save- the- dates, invitations, programs, etc.)	C	75	1
Recommend vendors	D	80	8
Schedule and accompany to any and all vendor appointments including site inspections, initial consultations, taste testing's etc. (as needed)	E	75	6
Assist in finding and securing ceremony and reception sites	F	50	10
Assist with menu selection and ordering	G	0	0
Review contracts	H	0	0
Assist with planning music	I	75	4
Coordinate and direct rehearsal	J	35	3
Coordinate and schedule all hair and make-up rehearsal appointments for event hosts	K	40	2
Coordinate event party transportation, dressing areas, etc	L	45	1
Ensure all details of the event day are in place and everyone directly involved is educated on and comfortable with their roles and responsibilities	M	0	0
Ensure that event hosts to provide: copies of all vendor contracts, details of event plants, event day time-line, schedule of events, complete detail list of event	N	95	1
Meet with John and Emily to discuss any last minute changes, review the event day time-line, go over details of event as well as set-up/breakdown,	O	0	0
Create final draft of timelines, schedules, seating charts, etc as needed and distribute to appropriate people	P	110	1
Direct Event Rehearsal	Q	0	0
Event Day Onsite <ul style="list-style-type: none"> <li>○ Oversee set up</li> <li>○ Direct ceremony</li> <li>○ Act as liaison between all vendors and event hosts</li> </ul>	R	0	0

Table 3: Activities start and finish times

Activity	Earliest start time	Earliest finish time	Latest start time	Latest finish time	Slack
A	0	1	0	1	0
B	1	15	1	15	0
C	15	22	15	22	0
D	22	43	22	43	0
E	43	61	43	61	0
F	61	91	61	91	0
G	91	92	109	110	18
H	92	93	110	111	18
I	91	101	91	101	0
J	101	106	101	106	0
K	91	98	99	106	8
L	106	111	106	111	0
M	111	113	111	113	0
N	113	117	113	117	0
O	117	118	117	118	0
P	118	121	118	121	0
Q	121	122	121	122	0
R	122	123	122	123	0
Project completion time	123				

Figure 1: Precedence Network Diagram for John and Emily’s wedding project

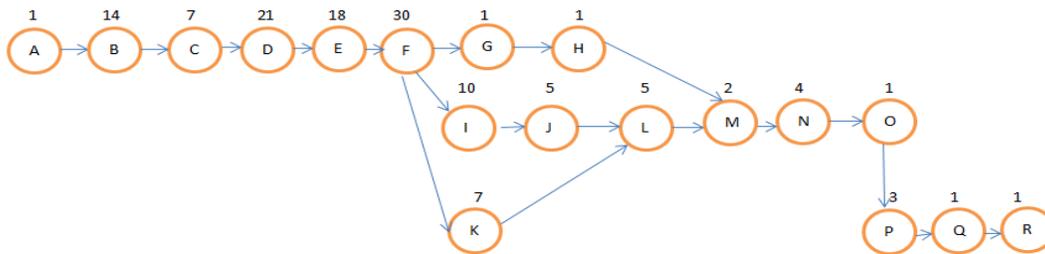


Figure 2: Data for the Gantt chart

	A	B	C	D
1				
2	Gantt Chart Data			
3				
4	Description	Start Time	Duration	
5	Create an overall timeline and perform budget analysis	0	1	
6	Assistance in shopping for event attire	1	14	
7	Assistance in selecting all paper products (save-the-dates, invitations, programs, etc.)	15	7	
8	Recommend vendors	22	21	
9	Schedule and accompany to any and all vendor appointments including site inspections, initial consultations, taste testing's etc. (as needed)	43	18	
10	Assist in finding and securing ceremony and reception sites	61	30	
11	Assist with menu selection and ordering	91	1	
12	Review contracts	92	1	
13	Assist with planning music	91	10	
14	Coordinate and direct rehearsal	101	5	
15	Coordinate and schedule all hair and make-up rehearsal appointments for event hosts	91	7	
16	Coordinate event party transportation, dressing areas, etc	106	5	
17	Ensure all details of the event day are in place and everyone directly involved is educated on and comfortable with their roles and responsibilities	111	2	
18	Ensure that event hosts to provide: copies of all vendor contracts, details of event plans, event day time-line, schedule of events, complete detail list of event	113	4	
19	Meet with John and Emily to discuss any last minute changes, review the event day time-line, go over details of event as well as set-up/breakdown,	117	1	
20	Create final draft of timelines, schedules, seating charts, etc as needed and distribute to appropriate people	118	3	
21	Direct Event Rehearsal			
22	Event Day Onsite	121	1	

Figure 3: John and Emily's wedding project Gantt chart

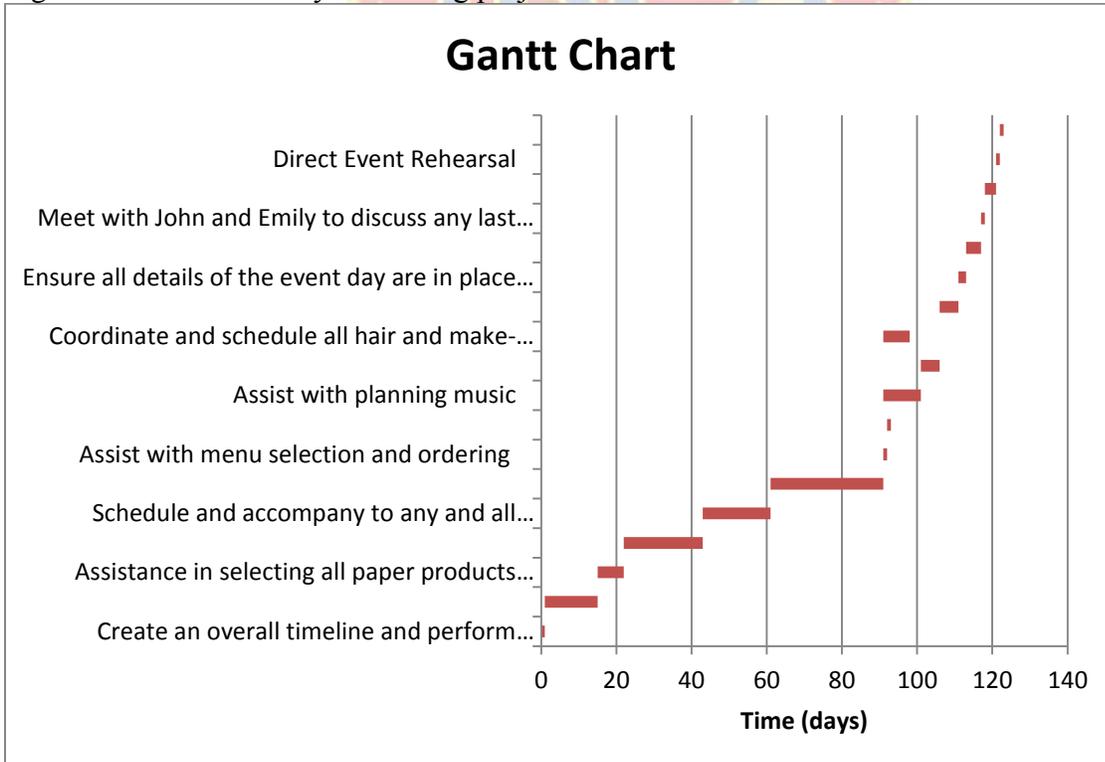


Figure 4: The critical path sequence

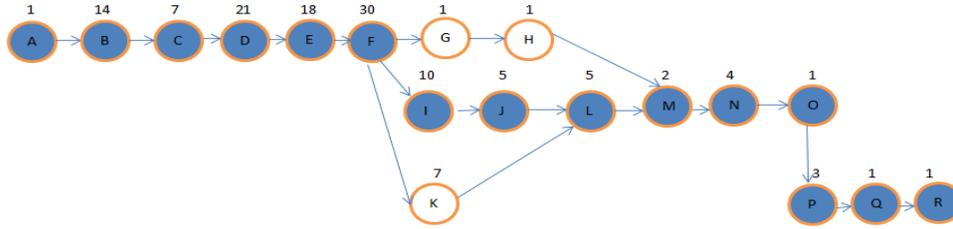


Figure 5: Cost calculations

	A	B	C	D
25				
26	Description	Duration	Cost Per day	Total Cost
27	Create an overall timeline and perform budget analysis	1	100	\$100
28	Assistance in shopping for event attire	14	50	\$700
29	Assistance in selecting all paper products (save-the-dates, invitations, programs, etc.)	7	55	\$385
30	Recommend vendors	21	60	\$1,260
31	Schedule and accompany to any and all vendor appointments including site inspections, initial consultations, taste testing's etc. (as needed)	18	50	\$900
32	Assist in finding and securing ceremony and reception sites	30	40	\$1,200
33	Assist with menu selection and ordering	1	80	\$80
34	Review contracts	1	80	\$80
35	Assist with planning music	10	60	\$600
36	Coordinate and direct rehearsal	5	25	\$125
37	Coordinate and schedule all hair and make-up rehearsal appointments for event hosts	7	30	\$210
38	Coordinate event party transportation, dressing areas, etc	5	35	\$175
39	Ensure all details of the event day are in place and everyone directly involved is educated on and comfortable with their roles and responsibilities	2	70	\$140
40	Ensure that event hosts to provide: copies of all vendor contracts, details of event plans, event day time-line, schedule of events, complete detail list of event	4	75	\$300
41	Meet with John and Emily to discuss any last minute changes, review the event day time-line, go over details of event as well as set-up/breakdown,	1	100	\$100
42	Create final draft of timelines, schedules, seating charts, etc as needed and distribute to appropriate people	3	90	\$270
43	Direct Event Rehearsal	1	100	\$100
44	Event Day Onsite	1	125	\$125
45				\$6,850

Figure 6: Crashing model- Excel Solver

Description	Label	Predecessors	Successors	Duration	Original Duration	Crash Amount	Max Crash	Cost Per Day
Create an overall timeline and perform budget analysis	A	None	B	1	1	0	0	0
Assistance in shopping for event attire	B	A	C	14	14	0	2	70
Assistance in selecting all paper products (save-the-dates, invitations, programs, etc.)	C	B	D	6	7	1	1	75
Recommend vendors	D	C	E	15	21	8	8	80
Schedule and accompany to any and all vendor appointments including site inspections, initial consultations, taste testing's etc. (as needed)	E	D	F	12	18	6	6	75
Assist in finding and securing ceremony and reception sites	F	E	G,I,K	20	30	10	10	50
Assist with menu selection and ordering	G	F	H	1	1	0	0	0
Review contracts	H	G	M	1	1	0	0	0
Assist with planning music	I	F	J	6	10	4	4	75
Coordinate and direct rehearsal	J	I	L	2	5	3	3	33
Coordinate and schedule all hair and make-up rehearsal appointments for event hosts	K	F	L	7	7	0	2	40
Coordinate event party transportation, dressing areas, etc	L	J,K	M	4	5	1	1	45
Ensure all details of the event day are in place and everyone directly involved is educated on and comfortable with their roles and responsibilities	M	H,L	N	2	2	0	0	0
Ensure that event hosts to provide: copies of all vendor contracts, details of event plans, event day time-line, schedule of events, complete detail list of event	N	M	O	3	4	1	1	95
Meet with John and Emily to discuss any last minute changes, review the event day time-line, go over details of event as well as set-	O	N	P	1	1	0	0	0
Create final draft of timelines, schedules, seating charts, etc as needed and distribute to appropriate people	P	O	Q	2	3	1	1	110
Direct Rehearsal	Q	P	R	1	1	0	0	0
Event Day Onsite	R	Q	END	1	1	0	0	0

Activity	Earliest start time	Earliest finish time
A	0	1
B	1	15
C	15	21
D	21	34
E	34	46
F	46	66
G	66	67
H	67	68
I	66	72
J	72	74
K	66	73
L	74	78
M	78	80
N	80	83
O	83	84
P	84	86
Q	86	87
R	87	88

Project completion time: 88 <= Deadline: 88

Crashing cost: \$ 2,320

Figure 7: Solver model parameters

**Solver Parameters**

Set Objective:

To:  Max  Min  Value Of:

By Changing Variable Cells:

Subject to the Constraints:

- Crash\_Amount <= Max\_Crash
- Project\_completion\_time <= Deadline

Make Unconstrained Variables Non-Negative

Select a Solving Method:

Solving Method  
Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.