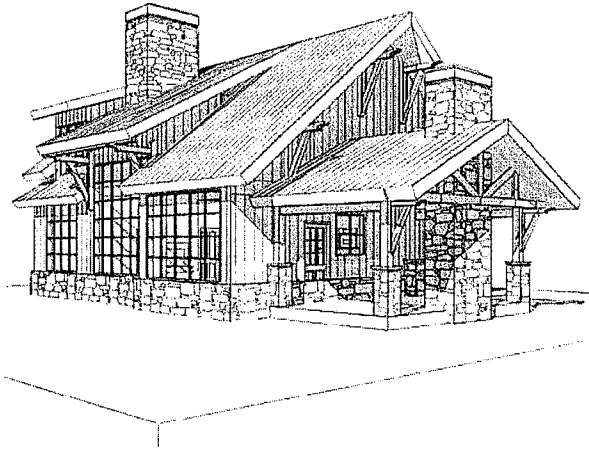


## CHAPTER THREE PROJECT: HOME REMODELING BID



### PREVIEW

In groups, students will analyze the steps required for a home remodeling/addition project. They will establish an ordering for these steps and assign contractors in a way that will minimize cost and project time. Students will submit a bid detailing their work schedule and labor costs. To simplify the problem, the materials cost will be predetermined and fixed at \$80,000.

### DAY 1 ACTIVITY: ANALYZING TASKS AND ESTABLISHING ORDER

Today your group needs first to select a name for your remodeling company. Then it should formulate a logical order for the following ten construction/remodeling steps:

- Install track lighting on ceiling.
- Apply roofing shingles.
- Erect roof.
- Lay tile flooring.
- Lay foundation.
- Erect sidewalls.
- Install electrical wiring.
- Install plumbing.
- Install wall air-conditioner.
- Obtain building permits.
- Put in door that connects new room to existing house.
- Install floor joists and subfloor.
- Sheet rock and finish work.
- Pick out paint colors, tiles, lighting
- Clean up exterior
- Landscape

Decide whether some tasks CLEARLY must wait until other tasks are complete. For example, one cannot build a roof prior to erecting sidewalls. Also make note of tasks that can be performed simultaneously. If you are not clear about the logical sequence of home construction, please consult this link on the web:

<http://home.howstuffworks.com/house.htm>

**DAY 2 ACTIVITY: FORMING AN ORDER-REQUIREMENT DIAGRAM**

Below is a list of the times and number of contractors necessary for each task:

Task #	Task Description	Number of Contractors	Time Per Contractor	People-Hours
T <sub>1</sub>	Install track lighting on ceiling	1	4	4
T <sub>2</sub>	Erect roof structure	2	6	12
T <sub>3</sub>	Lay tile flooring	1	5	5
T <sub>4</sub>	Paint exterior	1	8	8
T <sub>5</sub>	Lay foundation (*T <sub>5B</sub> = 5 days)	2	10	20
T <sub>6</sub>	Erect sidewalls	1	6	6
T <sub>7</sub>	Install electrical wiring	2	5	10
T <sub>8</sub>	Install exterior siding	1	8	8
T <sub>9</sub>	Install plumbing	2	6	12
T <sub>10</sub>	Install wall air-conditioner	1	2	2
T <sub>11</sub>	Paint interior	1	6	6
T <sub>12</sub>	Obtain building permits	1	2	2
T <sub>13</sub>	Install connecting door	1	2	2
T <sub>14</sub>	Apply roofing shingles	1	6	6
T <sub>15</sub>	Install floor joists and subfloor	2	5	10
T <sub>16</sub>	Sheet rock and finish work	2	10	20
T <sub>17</sub>	Install windows	1	5	5
T <sub>18</sub>	Pick out colors, tile, lighting	1	8	8
T <sub>19</sub>	Clean up exterior	2	3	6
T <sub>20</sub>	Landscape	2	5	10

Using the job times provided and the task orders discussed on the first day, your team should construct an order-requirement digraph. It should also compute the digraph's critical path. Note that in the order-requirement digraph, the tasks will not follow the order of their subscripts found in this table. Also note that times found in the fourth column (Time Per Contractor) are the task times that should appear in your digraphs.

### **DAY 3 ACTIVITY: FORMING A SCHEDULE**

Before forming a schedule for this remodeling job, keep in mind several assumptions. If a task requires two contractors, both contractors will start simultaneously and work until that task is finished. For tasks which require only one contractor, only one contractor will work on that task. That is, remember that your team should not build a schedule in which two or more contractors team up on a job that requires only one. Furthermore, a task will always be completed by a contractor before he/she starts a new task.

Contractors will not work more than twelve hours on any given day, but they must be paid for eight hours on each day they show up. After eight hours of work on a given day, a new task will not be started. Plumbers and electricians will only be paid for the hours they work (not a full 8 hours). No workers require overtime pay and they are available seven days a week. All tasks are performed by contractors who are paid \$18/hour, with the exception of plumbing and electrical work which costs \$30/hour.

Finally, keep in mind that after the foundation is poured, the concrete must cure for five days before the floor and walls can be constructed. All work stops on rainy days (but the foundation can cure on rainy days). \*Be sure to add  $T_{5B} = 5$  days of 12 hours each, no workers needed.

### **PROJECT FINAL: MAKE A BID**

Your team should compile a bid portfolio that includes the daily project schedule and the completion date. Work will begin on June 1<sup>st</sup>. For each scheduled day of the project, your team must include in the bid a \$150 charge for renting equipment. The schedule should also compute daily labor costs, the total of labor costs, the materials (which cost \$80,000) and a 20% profit the company will add on to the bottom line of the bid.

Remember the goal of this project: to build a schedule that makes a lowest possible bid but that will also generate a highest profit.

After your team finishes its bid portfolio, teams will exchange portfolios and your team will look for errors in the digraph and calculations. The teacher will then provide the weather report for the month of June and teams will help calculate the actual costs for each bid portfolio.



## **LETTER REQUIREMENTS FOR BID PROPOSAL**

Write a letter to Mr. and Mrs. Alfred Newman at P.O. Box 6364, Kent, Washington 98042 with your proposal

The letter is in formal business format, size 12 font, and should include the following

- The number of days set aside for the project
- The cost of the project
- Any other pertinent information

The letter will be scored with the rubric attached.

## **Remodel Project Bid Portfolio**

### **Table of Contents**

- **Order Requirement Di-graph with Critical Path in Red**
- **Scheduling Worker Worksheet**
- **Scheduling Workers Template**
- **Spreadsheet for Labor Costs**
- **Spreadsheet for Bid Proposal**
- **Final Bid Proposal Letter**

## **Remodel Bidding Project Order-Requirement Digraph**

Draw the order requirement digraph below and mark the critical path in red.

Critical Path = \_\_\_\_\_ hours

## **Remodeling Bidding Project Scheduling of Workers**

**Draw a scheduling chart for the workers needed each day of the project.**

# Business Letter Format Tips

When creating business letters, use 8 ½" by 11" unlined paper. Although 24-pound paper with 100+ brightness is a little more expensive, it will make a better impression than everyday copy paper. Use 1" margins on all four sides. Use a serif font such as Times Roman (12 point) or Georgia (11 point). A business letter should be single-spaced and, if possible, typed on a computer. Print the letter on only one side of the paper. Fold the letter horizontally into thirds. Mail the letter in a No. 10 security envelope (4 1/8" by 9 ½").

There are several business letter formats, but all of them can be subdivided into two basic groups: the block format and various indented formats. Although the block format is somewhat more common, (perhaps because it is easier), either one is acceptable. All conventional formats contain the same features:

## **1. Return address of the letter writer.**

1600 Main Street

Springfield, Kansas 12345

## **2. The date of the letter.**

This is usually typed in one of two ways:

(Begin with the day, no comma) 15 January 2006 or

(Begin with the month; use a comma) December 1, 2006

## **3. Complete name, title, and address of the recipient.**

Use "Mr." for a male recipient. If you do not know how a female recipient prefers to be addressed, it is best to use "Ms."

Ms. Anna Brown, Chair

Department of Linguistics

Right State University

1415 University Drive

Felicity, OH 45434

#### **4. Salutation with a colon.**

Dear Ms. Brown:

#### **5. Body of the letter.**

It is best to keep an initial business letter short. Business people are busy and do not have time to read long letters! In a one-page letter, you will usually only need three or four paragraphs, single spaced. Use a double space in between paragraphs. See examples that follow.

#### **6. Closing.**

The most common closing is "Sincerely." Follow this with a comma. Skip four single lines after the closing and type your name. Sign your name in the space above your name.

Sincerely,

Jonathan Wilson

#### **7. Enclosure.**

If you are enclosing additional information with your letter such as a resume or a curriculum vitae, skip two single lines after your typed name and type "Enclosure" or "Enclosures." If you use the plural, you have the option of stating the number of enclosures in parentheses.

Enclosures (2)

## Block Format

Type every line flush with the left margin, beginning at the top margin.

1600 Main Street  
Springfield, Kansas 12345

December 1, 2006

Ms. Anna Brown, Chair  
Department of Linguistics  
Right State University  
1415 University Drive  
Felicity, OH 45435

Dear Ms. Brown:

I want you to know you have an exceptional employee, Jane Doe, in your support division. Her calm, patient manner was a great help to me when my frustration was at an all-time high. Her knowledge of the software and her remarkable problem-solving abilities are rare indeed. If the quality of a firm's employees is an indication of future success, then Doe Corporation has a very bright future.

Sincerely,

John Doe

Enclosure

**BUSINESS LETTER RUBRIC**

<input type="checkbox"/> 4	Complies with all the requirements for a block format business letter (typed).
<input type="checkbox"/> 3	Complies with almost all the requirements for a block format business letter (typed).
<input type="checkbox"/> 2	Complies with several of the requirements for a block format letter (typed).
<input type="checkbox"/> 1	Complies with less than 75% of the requirements for a friendly letter, possibly hand written.

## HOME REMODELING BID GRADING RUBRIC

### DI-GRAPH ANALYSIS

<input type="checkbox"/> 4	Diagrams and/or sketches are clear and greatly add to the reader's understanding of the procedure(s). There are no order requirement errors and the graph shows some simultaneous tasks.
<input type="checkbox"/> 3	Diagrams and/or sketches are clear and easy to understand. There are no order requirement errors, but the graph is mostly linear.
<input type="checkbox"/> 2	Diagrams and /or sketches are somewhat difficult to understand. There is one order requirement error.
<input type="checkbox"/> 1	Diagrams and/or sketches are difficult to understand or are not used. There may be several order requirement errors.

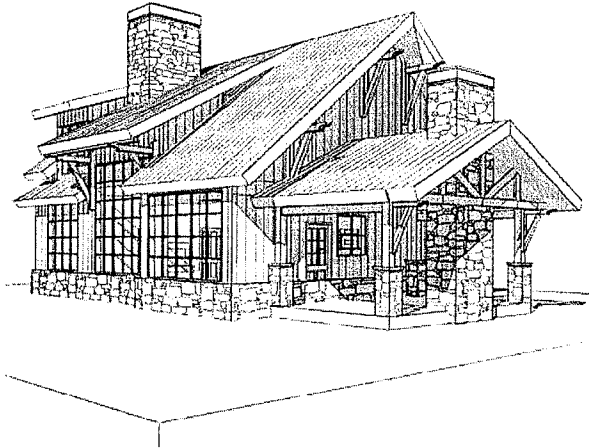
### CALCULATIONS

<input type="checkbox"/> 4	All (95-100%) of the steps and solutions have no mathematical errors (labor, time, or bidding errors).
<input type="checkbox"/> 3	Almost all (85-94%) of the steps and solutions have no mathematical errors (labor, time, or bidding errors).
<input type="checkbox"/> 2	Most (75-84%) of the steps and solutions have no mathematical errors (labor, time, or bidding errors).
<input type="checkbox"/> 1	There are several errors in calculating labor cost, time frame, and/or bidding.

<b>BIDDING PORTFOLIO</b>	
<input type="checkbox"/> 4	All bidding forms are complete, di-graph with critical path, scheduling workers per day, labor costs per day, materials costs, and bid proposal with profit calculated in.
<input type="checkbox"/> 3	All bidding forms are complete but there is a calculation error on one sheet (di-graph with critical path, scheduling workers per day, labor costs per day, materials costs, and bid proposal with profit calculated in).
<input type="checkbox"/> 2	All bidding forms are complete but there are two or three errors on forms (di-graph with critical path, scheduling workers per day, labor costs per day, materials costs, and bid proposal with profit calculated in).
<input type="checkbox"/> 1	Several of the forms are not completed or there are more than three mistakes on the forms.

<b>BUSINESS LETTER RUBRIC</b>	
<input type="checkbox"/> 4	Complies with all the requirements for a block format business letter (typed).
<input type="checkbox"/> 3	Complies with almost all the requirements for a block format business letter (typed).
<input type="checkbox"/> 2	Complies with several of the requirements for a block format letter (typed).
<input type="checkbox"/> 1	Complies with less than 75% of the requirements for a friendly letter, possibly hand written.

## CHAPTER THREE PROJECT: HOME REMODELING BID TEACHER SOLUTION



### **PREVIEW:**

In groups, students will analyze the steps required for a home remodeling/addition project. They will establish an ordering for these steps and assign contractors in a way that will minimize cost and project time. Students will submit a bid detailing their work schedule and labor costs. To simplify the problem, the materials cost will be predetermined and fixed at \$80,000. The tasks for student groups are broken down into a three-day schedule where about twenty minutes of class time will be required each day.

### **DAY 1 ACTIVITY: ANALYZING TASKS AND ESTABLISHING ORDER**

Introduce the project to each student group. On this day, students need first to select a name for their remodeling company. Then students should formulate a logical order for the following ten construction/remodeling steps:

- Install track lighting on ceiling.
- Apply roofing shingles.
- Erect roof.
- Lay tile flooring.
- Lay foundation.
- Erect sidewalls.
- Install electrical wiring.
- Install plumbing.
- Install wall air-conditioner.
- Obtain building permits.
- Put in door that connects new room to existing house.
- Install floor joists and subfloor.
- Sheet rock and finish work.

Students should decide whether some tasks CLEARLY must wait until other tasks are complete. For example, one cannot build a roof prior to erecting sidewalls. Students should also make note of tasks that can be performed simultaneously. If students and/or instructor are not clear about the logical sequence of home construction, please consult this link on the web:

<http://home.howstuffworks.com/house.htm>

Also you might want to have a general brainstorm session with the class on the order of jobs.

### **DAY 2 ACTIVITY: FORMING AN ORDER-REQUIREMENT DIAGRAPH**

Provide students with the times and number of contractors necessary for each task:

Task #	Task Description	Number of Contractors	Time Per Contractor	People-Hours
T <sub>1</sub>	Install track lighting on ceiling	1	4	4
T <sub>2</sub>	Erect roof structure	2	6	12
T <sub>3</sub>	Lay tile flooring	1	5	5
T <sub>4</sub>	Paint exterior	1	8	8
T <sub>5</sub>	Lay foundation (*T <sub>5B</sub> = 5 days)	2	10	20
T <sub>6</sub>	Erect sidewalls	1	6	6
T <sub>7</sub>	Install electrical wiring	2	5	10
T <sub>8</sub>	Install exterior siding	1	8	8
T <sub>9</sub>	Install plumbing	2	6	12
T <sub>10</sub>	Install wall air-conditioner	1	2	2
T <sub>11</sub>	Paint interior	1	6	6
T <sub>12</sub>	Obtain building permits	1	2	2
T <sub>13</sub>	Install connecting door	1	2	2
T <sub>14</sub>	Apply roofing shingles	1	6	6
T <sub>15</sub>	Install floor joists and subfloor	2	5	10
T <sub>16</sub>	Sheet rock and finish work	2	10	20
T <sub>17</sub>	Install windows	1	5	5
T <sub>18</sub>	Pick out colors, tile, lighting	1	8	8
T <sub>19</sub>	Clean up exterior	2	3	6
T <sub>20</sub>	Landscape	2	5	10

Using the job times provided and the task orders discussed on the first day, students should construct an order-requirement digraph. Students should also compute the digraph's critical path. Note that in the order-requirement digraph, the tasks will not follow the order of their subscripts found in this table. Also note that times found in the fourth column (Time Per Contractor) are the task times that should appear in students' digraphs.

### **DAY 3 ACTIVITY: FORMING A SCHEDULE**

This might be another day where there needs to be some group discussion about the requirements of this job.

Before forming a schedule for this remodeling job, students should be given several assumptions. If a task requires two contractors, both contractors will start simultaneously and work until that task is finished. For tasks which require only one contractor, only one contractor will work on that task. That is, students should not build a schedule in which two or more contractors team up on a job that requires only one. Furthermore, a task will always be completed by a contractor before he/she starts a new task.

Contractors will not work more than twelve hours on any given day, but they must be paid for eight hours on each day they show up. After eight hours of work on a given day, a new task will not be started. Plumbers and electricians will only be paid for the hours they work (not a full 8 hours). No workers require overtime pay and they are available seven days a week. All tasks are performed by contractors who are paid \$18/hour, with the exception of plumbing and electrical work which costs \$30/hour.

Finally, keep in mind that after the foundation is poured, the concrete must cure for five days before the floor and walls can be constructed. All work stops on rainy days (but the foundation can cure on rainy days). Students should add  $T_{5B} = 5$  days of 12 hours each, no workers needed.

### **HOMEWORK: MAKE A BID**

Students should compile a bid portfolio that includes the daily project schedule and the completion date. Work will begin on June 1<sup>st</sup>. For each scheduled day of the project, students must include in the bid a \$150 charge for renting equipment. The schedule should also compute daily labor costs, the total of labor costs, the materials (which cost \$80,000) and a 20% profit the company will add to the bottom line of the bid.

Have student groups exchange bid portfolios and check for errors in calculations and on the digraph. Give them a grading rubric.

Finally, the instructor will find local weather records for a randomly selected year (Perhaps the year that the students were born). Each rainy day will delay finishing the construction, and the remodeling company will be fined \$500 by the client for each day that completion is delayed beyond the projected completion date. Hence, it may be wise

to schedule a few rain-delay days (on which labor costs are zero). This will avoid some of the rain-delay penalties, but it will also cause the bid to increase because of the \$150.

**Remind students of the goal of this project: to build a schedule that makes a lowest possible bid but that will also generate a highest profit.**