# MECH 431
# Assignment #1 – Man in the Box

**Question 1 (10 marks):**

Olivia, after binge watching Gold Rush, has leased a small placer gold claim in the Yukon. For her first season she plans to mine it using a single bulldozer, one front end loader and an old processing plant. Based on drill records for the claim, she anticipates an average gold grade of 0.5 grams per cubic meter of gold containing gravel (paydirt). Based on the same drill records, she expects the claim has a stripping ratio of 1:1 (on average she must remove 1 cubic meter of worthless overburden in order to expose 1 cubic meter of paydirt.)

Running all the equipment costs $150 per hour total, and based on labour rules she can operate at most 12 hours per day. The bulldozer and loader together can move 30 cubic meters of dirt per hour. The processing plant can process up to 25 cubic meters of paydirt per hour.

She analyzed the processing plant recoveries on the show, and estimates her plant running at peak efficiency will recover 90% of the available gold in the paydirt. However, knowing this is her first season she recognizes her initial recovery rate will not be that good. She estimates it will take her a month (30 days) to get the plant up to 90% recovery. Looking at the new miners on the show, she estimates her recovery rate for the first paydirt she runs through will be 50%.

Olivia must pay the claim owner a royalty of 10% of her recovered gold for the first 5000 grams, 15% on the next 5000 and 20% on all gold above that. The price of gold is $60 per gram. She expects the mining season to last 160 days before weather makes it impossible to continue.

If Olivia spends $150,000 on her equipment,

1. when will she break even this season? [2]
2. What is her marginal cost of producing an additional gram of gold? [2]
3. How does this vary through the season? [2]
4. Produce a cost/revenue chart for the operation. Note key points and areas on the chart. What is Olivia's total profit or loss for the season? [3]
5. Olivia is considering leasing additional equipment to increase production. Discuss (you don't need to calculate anything) how the increasing royalty rate on production might impact Olivia's decision. [1]

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**Question 2 (10 marks):**

Rock band Alice in Chains (AiC) is just about to release their latest studio album, and are planning a tour to promote it. AiC spent $40,000 of their own funds to produce the album, and arranged a distribution deal with Gonzo Records that will pay the band $1 for every copy of the album sold.

The band is initially planning a nine month tour, with two shows per month as per the table below

| Month | Location | Travel Costs | Venue Rental | Venue Size |
|---|---|---|---|---|
| January | Tacoma | $ 1,000 | $ 50,000 | 2,000 |
| | Portland | $ 1,000 | $150,000 | 5,000 |
| February | San Francisco | $ 1,000 | $150,000 | 5,000 |
| | Los Angeles | $ 1,000 | $180,000 | 5,000 |
| March | San Diego | $ 1,000 | $150,000 | 5,000 |
| | Tampa | $ 5,000 | $180,000 | 5,000 |
| April | Washington, DC | $ 3,000 | $ 60,000 | 2,000 |
| | Baltimore | $ 1,000 | $ 50,000 | 2,000 |
| May | New York City | $ 1,000 | $250,000 | 8,000 |
| | Philadelphia | $ 1,000 | $225,000 | 8,000 |
| June | Boston | $ 1,000 | $180,000 | 5,000 |
| | Chicago | $ 3,000 | $150,000 | 5,000 |
| July | Denver | $ 3,000 | $150,000 | 5,000 |
| | Phoenix | $ 3,000 | $125,000 | 5,000 |
| August | Las Vegas | $ 1,000 | $ 70,000 | 2,000 |
| | Houston | $ 1,000 | $ 50,000 | 2,000 |
| September | Austin | $ 1,000 | $ 50,000 | 2,000 |
| | Seattle | $ 5,000 | $325,000 | 10,000 |

The band will need to lease $100,000 worth of equipment before starting the tour, regardless of how many shows it does. Every show has a setup/teardown cost. It costs a flat $6500 per show to do setup and teardown. Venue rental fees must be paid in full one month prior to the show. Setup and travel costs must be paid at the time of the show. Ticket revenues are received by the band one month after the show.

All shows are expected to sell out. Average ticket price is $50. TicketGrabber collects a 10% fee and passes the rest on to the band.

1. Provide a cash flow diagram for the tour. [2]
2. What are the total costs, revenues, and profits or losses for the tour? What is the average cost per show? [2]
3. How much cash on hand does AiC need to finance the tour? At what point does the tour become cash positive? [2]
4. Describe what costs would be added if the band added an additional show at a new location at the end of the tour. Describe how this would affect the average cost per show. (you don't need to do the calculations, just discuss these) [2]
5. If the show in San Diego proves exceptionally popular, what is the marginal cost of adding a second show at that location (assume the shows are back to back and the band stays in town). What is the marginal profit if the second show sells out? How many tickets need to be sold to break even on an extra show? [2]

Bonus Question: What is your favorite Alice in Chains song?