EGR 312 ENGINEERING ECONOMY
PRACTICE TEST 2

1. An entrepreneur has been given an opportunity to lease office space for a new business. The space will require $2500 in renovations up front (payable by the entrepreneur), and the lease payments will be $250 per month. The entrepreneur expects the business to generate revenues of $380 per month. If the entrepreneur expects to remain in the office space for 2 years and his MARR is 12% per year compounded monthly, should the entrepreneur lease the office space?

   PW = $261.64
   AW = $12.32
   ROR = 1.85%

   LEASE THE SPACE

2. ~~How long will the entrepreneur be in the office space before the decision becomes profitable (that is, what is the payback period, in months, for leasing this space)?~~

   ~~**21.46 MONTHS**~~

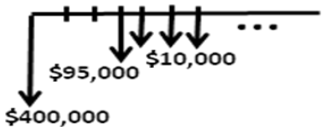
3. To alleviate congestion on a major highway, a state government plans to finance a new bridge for freight and express traffic using 10-year bonds that pay a coupon (bond interest) rate of 6% per year, payable quarterly. If the state is authorized to issue bonds with a total face value of $1,000,000 and investors are willing to pay $950,000, what are the effective quarterly and nominal annual interest rates for this bond investment?

   i = 1.67% / quarter r = 20.04% / year

4. Assume the bridge in problem 3 will cost $1.5 million to construct and will require an overhaul every 8 years at a cost of $250,000. These costs are expected to be covered by tolls and usage fees. If the MARR is 6% per year, how much revenue must the tolls and fees bring in each year to cover the cost of the bridge into perpetuity (i.e., forever)?

   $115,259

5. As an alternative to the bridge in problem 3, the state could choose to upgrade the current highway bridge to accommodate more traffic. The upgrade will cost $400,000 now, an additional $95,000 in 3 years, and $10,000 per year every year after that. The MARR is still 6%.
   a) Draw the cash flow diagram.



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   b) What is the capitalized cost (present worth) of this alternative?

      $619,700.38

   c) A transportation expert informs you that the tolls and fees from the new bridge will most likely cover only 50% of the costs. With this new information, and from a purely economic perspective, which alternative (new “express” bridge or upgrade

existing) would you recommend? Justify your answer (note: you do not have to perform any additional financial calculations.)

UPGRADE EXISTING (1/2 COSTS > AW OF COST OF UPGRADE)

6. *Poetry in Motion*, a mobile phone applications company, is trying to decide on a new product line. Five projects are ready for final testing and product launch. The company's MARR is 9.5%.

   a) The costs and expected revenues of the projects (in thousands of dollars), along with their rates of return, are given below. If the projects are independent, which one(s) should the company launch this year? Justify your answer.

	PROJECT				
Year	**Allende**	**Angelou**	**Byron**	**Browning**	**Shelley**
0	$ (6,000)	$ (7,500)	$(5,800)	$ (8,500)	$ (6,750)
1	$ 1,025	$ 1,250	$ 780	$ 1,320	$ 1,050
2	$ 1,025	$ 1,250	$ 780	$ 1,320	$ 1,050
3	$ 1,025	$ 1,250	$ 780	$ 1,320	$ 1,050
4	$ 1,025	$ 1,250	$ 780	$ 1,320	$ 1,050
5	$ 1,025	$ 1,250	$ 780	$ 1,320	$ 1,050
6	$ 1,025	$ 1,250	$ 780	$ 1,320	$ 1,050
7	$ 1,025	$ 1,250	$ 780	$ 1,320	$ 1,050
8	$ 1,025	$ 1,250	$ 780	$ 1,320	$ 1,050
9	$ 1,025	$ 1,250	$ 780	$ 1,320	$ 1,050
10	$ 1,525	$ 1,800	$ 1,280	$ 1,820	$ 1,600
ROR =	11.81%	11.17%	6.76%	9.47%	9.71%

ALLENDE, ANGELOU, AND SHELLEY (ROR > 9.5%)

   b) Concerned that launching more than one product this year will dilute the brand and potentially overstress the company's support systems, upper management has decided to only launch one project this year. Your task is to decide which project to launch. Based on the data given above, several potential analyses are given on the next page. At each stage of analysis you are to: 1) select the appropriate analysis (circle your choice); 2) make a decision based on that analysis; 3) decide whether you are done and ready to stop analyzing your options; and 4) either continue to the next stage or recommend a project to launch.

Stage 1:

Year	**Ang-All**
0	$ (1,500)
1	$ 225
2	$ 225
3	$ 225
4	$ 225
5	$ 225
6	$ 225
7	$ 225
8	$ 225

Year	**All-Byr**
0	$ (200)
1	$ 245
2	$ 245
3	$ 245
4	$ 245
5	$ 245
6	$ 245
7	$ 245
8	$ 245

Year	**She-All**
0	$ (750)
1	$ 25
2	$ 25
3	$ 25
4	$ 25
5	$ 25
6	$ 25
7	$ 25
8	$ 25

9	$	225	9	$	245	9	$	25
10	$	275	10	$	245	10	$	75
ROR =		8.48%	**ROR =**		122.46%	**ROR =**		-12.50%

Stop? __**NO**____

ALLENDE

Stage 2:

Year	**Byr-Ang**	**Year**	**Ang-All**	**Year**	**She-Byr**
0	$ 1,700	0	$ (1,500)	0	$ (950)
1	$ (470)	1	$ 225	1	$ 270
2	$ (470)	2	$ 225	2	$ 270
3	$ (470)	3	$ 225	3	$ 270
4	$ (470)	4	$ 225	4	$ 270
5	$ (470)	5	$ 225	5	$ 270
6	$ (470)	6	$ 225	6	$ 270
7	$ (470)	7	$ 225	7	$ 270
8	$ (470)	8	$ 225	8	$ 270
9	$ (470)	9	$ 225	9	$ 270
10	$ (520)	10	$ 275	10	$ 320
ROR =	24.68%	**ROR =**	8.48%	**ROR =**	25.66%

Stop? _**YES**_____

Stage 3:

Year	**Ang-She**	**Year**	**Bro-Byr**	**Year**	**She-Byr**
0	$ (750)	0	$ (2,700)	0	$ (950)
1	$ 200	1	$ 540	1	$ 270
2	$ 200	2	$ 540	2	$ 270
3	$ 200	3	$ 540	3	$ 270
4	$ 200	4	$ 540	4	$ 270
5	$ 200	5	$ 540	5	$ 270
6	$ 200	6	$ 540	6	$ 270
7	$ 200	7	$ 540	7	$ 270
8	$ 200	8	$ 540	8	$ 270
9	$ 200	9	$ 540	9	$ 270
10	$ 200	10	$ 540	10	$ 320
ROR =	23.41%	**ROR =**	15.10%	**ROR =**	25.66%

Recommendation: ____**ALLENDE**___

7. An engineering laboratory offers a quality inspection service to local industry. Two methods for performing inspections are proposed, with the following estimated net profit (revenue-cost). Visual inspection is performed by trained professionals who, after an

initial investment in training, can perform the inspections indefinitely but must be re-certified every 3 years. Automated inspections are performed using non-destructive testing equipment that must be replaced every 5 years. The interest rate is 10% per year.

	Visual Inspection	Automated Inspection
First Cost, $	10,000	21,000
Annual Profit, $	3000	5400
Salvage Value, $	---	8000
Certification cost (every 3 yrs.), $	5000	---
Life, years	∞	5

a) Draw the cash flow diagram for each alternative.

b) Based on an annual worth comparison, which method would you recommend?

VISUAL = $489 AUTOMATED = $1171

CHOOSE AUTOMATED

c) Regardless of your recommendation in part b, the laboratory manager wants to know the rate of return for visual inspections. Set up, BUT DO NOT SOLVE, the Excel spreadsheet you would use to perform find this rate of return. Be sure to provide enough information to show how you would determine the rate of return.

ANSWERS WILL VARY.