BAYLOR UNIVERSITY
HANKAMER SCHOOL OF BUSINESS
DEPARTMENT OF FINANCE, INSURANCE & REAL ESTATE

Risk Management
Dr. Garven
Final Exam
Fall 2020

Name _____

Instructions:

This test consists of two sections:

1. The first section has five multiple-choice questions worth 5 points each. For the multiple-choice questions, circle the response that you think is the best answer for each question.

2. The second section has three problems worth 24 points each.

Good luck!

Section 1. Five Multiple Choice Questions (5 points each)

1. Harold is indifferent between $2,500 for sure and a bet with a 60 percent chance of $2,400 and a 40 percent chance of $2,600. Harold is
    a. risk averse.
    b. risk loving.
    c. risk neutral.
    d. a profit maximizer.
    e. irrational.

2. A risk-averse person has a utility function that, with wealth on the horizontal axis and utility on the vertical axis, as wealth increases,
    a. is a horizontal line.
    b. is a vertical line.
    c. has constant, positive slope.
    d. is increasing at a decreasing rate.
    e. is increasing at an increasing rate.

3. You pay $3.75 to roll a normal die 1 time. You get $1 for each dot that turns up. Your expected profit from this venture is
    a. -$.75.
    b. -$.25.
    c. $.25.
    d. $3.00.
    e. $3.50.

4. Expected utility is
    a. the profit from a given decision.
    b. a probability weighted average of possible profits.
    c. an evenly weighted average of possibility profits.
    d. a probability weighted average of possible utility levels.
    e. the expected profits plus a number that depends on risk.

5. D.J. Trump is running for office with 500,000 voters who have pledged their support. To add more voters, he wants to choose n, the number of negative campaign ads to run, where $0 \leq n \leq 4$. The ads will backfire with probability $0.2n$ and give him no extra votes. Otherwise, the ads will not backfire (with probability $(1 - 0.2n)$) and give him $100{,}000 + 40{,}000n$ extra votes. So $n = 0$ implies a total of 600,000 votes. Assuming that D.J. Trump is *risk neutral*, he should choose to run ____ negative campaign ads (hint: round to the nearest integer value).
    a. 0.
    b. 1.
    c. 2.
    d. 3.
    e. 4.

Extra Space for solving Section 1 Questions:

Section 2. Three problems (24 points each)

Problem 2.1 (24 points)

An entrepreneur has initial wealth of $88. Her initial wealth is invested in two buildings, each of which is worth $40. Her remaining $8 in initial wealth is invested in cash. Each building has a 25% chance of being destroyed and a 75% chance of not suffering any damage. Because the buildings are located far away from each other, these risks are statistically independent.

Since the entrepreneur has $8 in cash, she can use some or all of this money to purchase actuarially fair insurance policies to cover her risks. Note that the price for an actuarially fair insurance policy equals the expected value of the payoff (indemnity) provided by the insurance policy.

A. (6 points) Given the entrepreneur's cash resources, if she covers 60% of the first building's potential loss, what is the maximum level of coverage (in terms of proportion of potential loss) that she can purchase against the risk that the second building will be destroyed?

B. (6 points) Given the entrepreneur's cash resources, what is the maximum level of coverage (in terms of proportion of potential loss) for each building that will result in the same premium being paid for each policy?

C. (6 points) Suppose the entrepreneur's utility function is $U(W) = \sqrt{W}$. Show that the entrepreneur is better off if she insures both buildings at the same level of coverage (for a total premium of $8) than she would be if she implemented the risk management strategy implied in Part A of this problem.

D. (6 points) Explain *why* the expected utility of having the same level of coverage on both buildings is higher than the expected utility of having different levels of coverage.

Extra Space for solving Problem #2.1

Problem 2.2 (24 points)

One of the industries most affected by oil prices is the airline industry. After labor costs, the price of jet fuel is typically the most important cost component for airline companies. In spite of this fact, hedging practices vary significantly within the industry. For example, Southeast Airlines (LOV) has more than half of its total jet fuel exposure hedged at the equivalent of $30-$40 per barrel of oil, whereas United States Airlines (USA) does not hedge any of its jet fuel exposure.

Currently, the market value of United States Airlines' assets is $26 billion, and it has promised to pay its bondholders $20 billion one year from now. Southeast Airlines holds assets worth $7 billion, and it has promised to pay its bondholders $3.5 billion one year from now. The riskless rate of interest is 5% per year, the standard deviation of the return on USA's assets is 50% per year, and the standard deviation of the return on LOV's assets is 30% per year.

A. (6 points) What is the total market value of USA debt? What is the yield to maturity for USA debt?

B. (6 points) What is the total market value of LOV debt? What is the yield to maturity for LOV debt?

Now suppose that the federal government initiates a loan guarantee program that requires taxpayers to fully guarantee USA and LOV bonds against the risk of default.

C. (6 points) What is the dollar value of the federal government's loan guarantee to USA bondholders? What effect does the initiation of the federal government's loan guarantee to USA have upon the yield to maturity for USA debt?

D. (6 points) What is the dollar value of the federal government's loan guarantee to LOV bondholders? What effect does the initiation of the federal government's loan guarantee to LOV have upon the yield to maturity for LOV debt?

Extra Space for solving Problem #2.2

Problem 2.3 (24 points)

Suppose that the (pre-loss and pre-tax) earnings of your company one period from now will be $600. However, your company's assets are subject to the following loss distribution:

L_s	Probability
$600	25%
$400	25%
$200	25%
$0	25%

The government assesses a tax rate of 50% on earnings exceeding $300, and a 0% tax rate whenever earnings fall below this amount. Assume that investors are risk neutral and the interest rate is 0 percent. Furthermore, assume that any insurance premiums paid are fully tax deductible, as are uninsured losses.

A. (6 points) Suppose that your company may fully insure this risk at an actuarially fair price. What would be the after-tax value of your company if you decided not to purchase insurance? What would be its value if you purchased insurance?

B. (6 points) What is the net present value of purchasing insurance?

C. (6 points) Do you recommend purchasing actuarially fair insurance? Why or why not?

D. (6 points) What would be your recommendation about buying insurance if the premium loading on this policy was 20 percent? Be sure to justify your answer.

Extra Space for solving Problem #2.3

FINAL EXAM FORMULA SHEET

1. Expected value

$$E(X) = \sum_{s=1}^{n} p_s X_s, \tag{1}$$

where p_s = the probability of state s (note: $\sum_{s=1}^{n} p_s = 1$) and X_s = the payoff when state s occurs.

2. Expected Utility

$$E\big(U(W)\big) = \sum_{s=1}^{n} p_s U(W_s), \tag{2}$$

where $U(W)$ = utility of state contingent wealth.

3. Option theory

Black-Scholes-Merton formula for a call option:

$$C = SN(d_1) - e^{-rT} KN(d_2), \tag{3}$$

Black-Scholes-Merton formula for a put option:

$$P = e^{-rT} KN(-d_2) - SN(-d_1), \text{ and} \tag{4}$$

Put-call parity theorem:

$$C + Ke^{-rT} = P + S, \tag{5}$$

where

C = current call option price;
P = current put option price;
S = current stock price;
K = strike or exercise price;
r = riskless rate of interest;
T = time to expiration;
σ^2 = variance of underlying asset's rate of return;
$d_1 = \dfrac{\ln(S/K) + (r + .5\sigma^2)T}{\sigma\sqrt{T}}$; and
$d_2 = d_1 - \sigma\sqrt{T}$.

Standard Normal Distribution Function

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990