

1 Exam Directions From Canvas Assignments

1.1 Exam Directions

Students must use Respondus Monitor with LockDown Browser, with a webcam on the relevant area for the duration of this exam. Before beginning the exam, the webcam should be placed at a location at which the entire work area can be seen, including the student's face and hands, at all times. No electronic devices other than a calculator should be brought into the testing environment; this includes smart watches. Communication of any kind with another person during this exam will be considered a violation of the academic integrity policy.

Once the webcam for Respondus Monitor is on, but before beginning the exam, students must clearly show their blank pages to the webcam, front and back.

This exam will consist of two sections: the Multiple Choice (MC) and Free Response (FR) sections.

MC Section: This Canvas assignment will include all MC questions, and they will be graded automatically in this assignment.

FR Section: It will appear as a single question on this exam; that question will include a list of all of the FR questions. You must write your work and answers on paper, and then scan all pages and upload them together as a single pdf (via an app such as Adobe Scan or CamScanner: NOT simply a phone picture) to the "Exam 2 pdf Upload" Canvas assignment (the assignment after this one on Canvas). This portion must be uploaded within 15 minutes of finishing the exam. Before logging off of this Respondus Monitor, you must hold up all sheets with your written work to the webcam so they can be read on the video. You also need to follow the directions given in the FR section during the exam. The FR portion will be graded by the grading team, and your score will be entered manually into this assignment.

Failure to follow any of the above guidelines will result in you losing 2 points on the exam (which is the final Free Response Question). Significant failure to follow these guidelines may result in the exam not being accepted and you being granted a score of zero for the exam.

Before beginning this exam, make sure that you have the following:

- tablet/laptop/similar device with Respondus Monitor and LockDown Browser (NOT a smartphone);
- a webcam in, or capable of being integrated into, the device in #1 (you will need to show your face, your picture ID, and your testing environment to begin the exam);
- device capable of scanning (with Adobe Scan or CamScanner), saving, and uploading pdf files (no other file type);
- sufficient internet connection;
- an approved calculator (TI-83, TI-84, or "Plus" versions of these);
- pencil and paper.

This exam is made available a little early and a little late on Canvas so that you have sufficient time to read these directions and perform the RM/LDB checks. However, note the time limit once you start the exam.

In the event of technical difficulties, contact your instructor immediately. You should continue to complete the exam if possible.

1.2 FR Directions

There are 5 (content-carrying) free response questions, each with multiple parts. Show all necessary work on your handwritten page (which you will scan and upload as a pdf).

Verify that the answers carry the appropriate units. Partial credit may be given for work towards the correct solution. However, if answers are shown without necessary work, you may receive little or no credit for the correct answer.

Free Response Questions: [Image Embedded]

Type your free response answers (ANSWERS ONLY) into the answer area for this question, marked with the question number. For example, your response should be formatted something like this:

#1) (a) your answer

(b) your answer

(c) your answer

#2) etc. ...

If your answer involves a chart, table, or diagram, type the appropriate word (e.g. "diagram") as your answer to this question.

Write your work and answers on a sheet of paper (remember to always include appropriate units, including % and \$ symbols when appropriate). Round answers to two decimal places unless otherwise instructed. Grading of both your work and your answers will primarily take place on this sheet of paper; the answers typed in above should duplicate the answers on your paper. When finished the exam, but before logging off of Respondus Monitor, show all of the pages of your work/answers to FR questions to the webcam so that they can be clearly read. Then log off of Respondus Monitor, scan the pages to create a single pdf, and upload the scanned pdf to the corresponding "Exam 2 pdf Upload" assignment.

1.3 Exam 2 pdf Upload Directions

Upload, as a single pdf, your handwritten work and answers to the Free Response section of the exam here.

After uploading, confirm that your upload has completed by downloading it again to make sure it is readable. A late upload or one that cannot be read/downloaded will result in a deduction of 10 points, and it might not be accepted at all at the instructor's discretion.

Your upload is due within 15 minutes of the exam ending. Failure to follow this policy may result in your exam responses not being accepted and you being given a score of zero for the Free Response portion of the exam.

Points earned on the free response section will be manually added to the Exam assignment on Canvas, not to this assignment.

2 MC: 3 points each, 60 points total. Correct answer is option (a).

1. If someone needed \$25,000 to maintain a certain standard of living in 1977, how much would they need to maintain the same standard of living in 2016? Round your answer to the nearest whole dollar.
 - (a) \$99,010
 - (b) \$6,313
 - (c) \$74,010
 - (d) \$25,000
2. Economists use an index number called the Big Mac Index to describe purchasing power parity of different currencies around the world. Create an index number for the dollar and the British pound, rounded to the nearest whole number. Use the following values, with British pounds as the reference value: compare \$3.57 to 2.29 British pounds.
 - (a) 156
 - (b) 64
 - (c) 56
 - (d) 2
3. Housing prices in San Francisco approximately tripled between 1994 and 2017. If we created a housing index number for San Francisco with 1994 as the reference year, then the index number for 1994 would be 100. Determine the approximate index number for 2017.
 - (a) 300
 - (b) 33
 - (c) 103
 - (d) 3
4. If you deposit \$4,500 into an account with an APR of 3% compounded monthly, how much money will you have in the account after 6 years? Round to the nearest cent.
 - (a) \$5,386.27
 - (b) \$5,373.24
 - (c) \$5,310.00
 - (d) \$6,241.84
 - (e) \$5,387.48
5. Consider an account with APR 7% and quarterly compounding. Find the APY, rounded to the nearest hundredth of a percent.
 - (a) 7.19%
 - (b) 1.07%
 - (c) 107.00%
 - (d) 7.00%
 - (e) 7.23%

6. Suppose you deposit \$5,000 into an account that earns simple interest at 6% APR, and a friend deposits \$5,000 into an account with a 6% APR compounding annually. After 2 years, how much more money do they have in their account than you do?
- (a) \$18.00
 - (b) \$5618.00
 - (c) \$300.00
 - (d) \$600.00
 - (e) \$54.00

7. Sarah opens a savings account with an APR of 5.25% with monthly compounding. If she deposits \$250 a month, how much will she have in 8 years?
- (a) \$29,746.74
 - (b) \$24,000.00
 - (c) \$30,143.82
 - (d) \$86,889.60
 - (e) \$2,408.73

8. In the savings plan formula

$$A = PMT \times \left[\frac{\left(1 + \frac{APR}{n}\right)^{(nY)} - 1}{\frac{APR}{n}} \right]$$

what do the variables A and PMT represent?

- (a) A is the accumulated balance after Y years; PMT is the monthly deposit
 - (b) A is the beginning balance of the account; PMT is the monthly deposit
 - (c) A is the accumulated balance after Y years; PMT is the beginning balance of the account
 - (d) A is the annual rate of interest; PMT is the accumulated balance after Y years
 - (e) A is the monthly deposit in the account; PMT is the accumulated balance after Y years
9. At age 30, Antonio opened an IRA that earned 4% APR and started making monthly deposits of \$100. When he retires at age 70, the account has \$118,196.13 in it. How much of that is interest?
- (a) \$70,196.13
 - (b) \$48,000.00
 - (c) \$4,727.85
 - (d) \$118,196.13
 - (e) \$85,201.31
10. A table which details the schedule of payments for paying off an installment loan is called a(n):
- (a) amortization table.
 - (b) interest table.
 - (c) formula schedule.
 - (d) loan book.
 - (e) mortgage schedule.

11. Ed borrows \$2700 at 8% APR. He makes monthly payments of \$85 towards the loan. Calculate his principal reduction in the first month.
- (a) \$67
 - (b) \$18
 - (c) \$85
 - (d) \$131
 - (e) -\$18
12. You have 3 options for a mortgage (installment loan), and you calculate the principal, P , for each one (the maximum that you can afford to borrow). Option A has $P = \$275,142$; option B has $P = \$331,757$; option C has $P = \$295,804$. If you want to borrow \$300,000 for a mortgage, which option should you choose?
- (a) B
 - (b) A
 - (c) C
 - (d) There is not enough information to answer this question.
13. Suppose your tax filing status is Head of Household, your adjusted gross income is \$56,275, and you claim the standard deduction. Find your taxable income.
- (a) \$37,925
 - (b) \$18,350
 - (c) \$56,275
 - (d) \$74,625
 - (e) There is not enough information to answer this question.
14. Your uncle has gross income of \$86,100 and he contributed \$9,000 to a tax-deferred IRA. He is single, claims the standard deduction, and is entitled to a tax credit of \$2,500. Find your uncle's adjusted gross income.
- (a) \$77,100
 - (b) \$64,900
 - (c) \$62,400
 - (d) \$74,600
 - (e) \$71,400
15. Quentin's taxable income is \$72,000, and his filing status is married filing jointly. He has no tax credits. Find the total income tax that he owes.
- (a) \$8,245
 - (b) \$9,235
 - (c) \$8,640
 - (d) \$2,965
 - (e) There is not enough information to answer this question.

16. Penelope is single, and she earned \$80,000 in wages and \$4,500 in interest from a savings account this year. She has no adjustments to her income, and she claims the standard deduction. Find her FICA tax. (Hint: the FICA tax rate is 7.65%)
- (a) \$6,120
 - (b) \$6,464.25
 - (c) \$13,390
 - (d) \$14,380
 - (e) There is not enough information to answer this question.
17. Penelope is single, and she earned \$80,000 in wages and \$4,500 in interest from a savings account this year. She has no adjustments to her income, and she claims the standard deduction. Find her tax bracket.
- (a) 22%
 - (b) 12%
 - (c) 24%
 - (d) 10%
 - (e) There is not enough information to answer this question.
18. In an election with only two candidates, the most straightforward voting method is:
- (a) majority rule.
 - (b) the U.S. electoral college combined with the Condorcet method.
 - (c) plurality with super majority.
 - (d) not known because some elections cannot declare a winner.
19. Which voting method uses pairwise comparisons among candidates?
- (a) Condorcet method
 - (b) Borda count method
 - (c) Plurality method
 - (d) All voting methods use pairwise comparisons
20. An election is being held, with the winner determined by the sequential runoff voting method. The preference schedule shows that no candidate has a majority of first place votes. Which candidate is eliminated?
- (a) The candidate with the fewest first place votes
 - (b) Whoever has the most Borda count points
 - (c) The candidate with the fewest pairwise comparison wins
 - (d) Whoever has a plurality

3 FR: Points as marked, 40 points total.

1. You are considering investing in gold, so you gather the following historical data: In 1996, the final price of gold was \$369 per oz. In 2016, it was \$1,152 per oz.

- (a) (2 points) What was the overall inflation rate from 1996 to 2016? Round your answer to the nearest whole percent.

Answer:

$$\frac{240.0 - 156.9}{156.9} \times 100\% = 52.96\% \approx 53\%.$$

0.5 point for use of correct formula.
 0.5 point for correct values in the correct places.
 0.5 point for correct computation.
 0.5 point for correct answer.
 -0.25 for incorrect rounding of answer.

- (b) (3 points) If you had one oz of gold in 1996, it would be worth \$369 in 1996 dollars. What would it be worth in 2016 dollars? Round to the nearest dollar.

Answer:

Either one of the following two answers is acceptable.

$$\frac{CPI_{2016}}{CPI_{1996}} = \frac{240.0}{156.9} = \frac{\$x}{\$369}$$

$$x = \$369 \left(\frac{240.0}{156.9} \right) \approx \$564.$$

OR

$$\$369 \times 1.53 \approx \$565.$$

1 point for use of correct formula (reciprocals okay).
 0.5 point for correct values in the correct places.
 1 point for correct computation.
 0.5 point for correct answer.
 -0.25 for incorrect rounding of answer.

- (c) (2 points) If you bought one oz of gold in 1996 and sold it in 2016, would you have seen a profit (adjusted for inflation)? Clearly write YES or NO and explain your answer. (Hint: compare your answer in part (b) to the price of gold in 2016.)

Answer:

YES, you would have seen a profit. One oz of gold purchased in 1996 was worth \$564 (or \$565) in 2016 (part (b)), so selling the oz for more than that in 2016 would return a profit. Since the price of gold in 2016 was \$1152 per oz and $1152 > 565$, you would have earned a profit.

1 point for correct answer (YES).
 1 point for legitimate explanation.
 (Incorrect answer and explanation can be given credit if they follow the work from part (b).)

2. You are saving to buy a used car, and you have \$6,500 available to deposit today. Two different accounts are available to you. The first account has an APR of 7% compounded monthly, and the second account has an APR of 5% compounded daily. (Remember to show work to support your answers below.)

- (a) (3 points) Which account should you choose if you want at least \$9,000 in 5 years?

Answer:

We can either calculate P for both accounts or A for both accounts. For account 1,

$$P_1 = \frac{9000}{\left(1 + \frac{0.07}{12}\right)^{12 \times 5}} = \$6,348.65$$

$$A_1 = 6500 \times \left(1 + \frac{0.07}{12}\right)^{12 \times 5} = \$9,214.56$$

For account 2,

$$P_2 = \frac{9000}{\left(1 + \frac{0.05}{365}\right)^{365 \times 5}} = \$7,009.33$$

$$A_2 = 6500 \times \left(1 + \frac{0.05}{365}\right)^{365 \times 5} = \$8,346.02$$

Comparing P_1 and P_2 , you only have enough money to open account 1.

Comparing A_1 and A_2 , only account 1 will allow you to reach your goal of \$9,000.

With either method of comparison, we should choose to open the first account.

1 point for use of a legitimate method (either of the two above, or an alternative method if valid).
0.5 point each for a correct computation for each account.
1 point for correct answer (account 1).

- (b) (3 points) If you instead have 7 years to save, what car price could you afford with EACH account? If a car is worth \$10,000 in 7 years, which account should you choose to open today?

Answer:

Calculate A for both accounts. For account 1:

$$A_1 = 6500 \times \left(1 + \frac{0.07}{12}\right)^{12 \times 7} = \$10,594.96$$

For account 2:

$$A_2 = 6500 \times \left(1 + \frac{0.05}{365}\right)^{365 \times 7} = \$9,223.72$$

Choose account 1 because it is the only one that allows you to afford a \$10,000 car in 7 years.

1 point for use of correct formula (reciprocals okay).
0.5 point for correct computation for each account.
1 point for correct answer (account 1).

- (c) (2 points) You receive a flyer in the mail for a new account option: an account earning 9.5% simple interest. If you deposit \$6,500 today into that account, would it provide you with enough money to buy a \$9,000 car in 5 years?

Answer:

$$6,500 + (6,500 \times 0.095 \times 5) = 9,587.50$$

YES, it would have more than \$9,000 in 5 years.

0.5 point for correct simple interest formula.

0.5 point for correct inputs into formula.

0.5 point for correct computation.

0.5 point for correct answer (YES).

3. In 2005, Brianna bought 350 shares of stock for \$20 per share. In 2020, she sold the stock for \$5,000.

(a) (3 points) Find Brianna's total return on investment. Round to the nearest hundredth of a percent.

Answer:

Calculate $P = \$20 \times 350 = \7000 . With $A = \$5,000$, total return is:

$$\text{Total Return} = \frac{\$5000 - \$7000}{\$7000} \times 100\% = -28.57\%$$

0.5 point for correct computation of P.
 0.5 point for use of correct formula.
 1 point for values in correct places in formula.
 0.5 point for correct computation.
 0.5 point for correct answer.
 -0.25 for incorrect rounding.

(b) (3 points) What was Brianna's annual return on her investment? Round to the nearest hundredth of a percent.

Answer:

$$\text{Annual Return} = \left[\left(\frac{\$5,000}{\$7,000} \right)^{1/15} - 1 \right] \times 100\% = -2.22\%$$

1 point for use of correct formula.
 1 point for values in correct places in formula.
 0.5 point for correct computation.
 0.5 point for correct answer.
 -0.25 for incorrect rounding.

(c) (2 points) In order to have a total return of at least 5%, what amount should Brianna have sold the stock for?

Answer:

We want total return $\geq 5\%$, so

$$\begin{aligned} \text{Total Return} &= \frac{A - \$7000}{\$7000} \times 100\% \geq 5\% \\ \frac{A - \$7000}{\$7000} &\geq 0.05 \\ A &\geq \$7000 + 0.05 \times \$7000 \\ A &\geq \$7350 \end{aligned}$$

Brianna should have sold for a minimum of \$7,350.

1 point for a correct problem set up (alternative formulations are okay).
 0.5 point for correct computation.
 0.5 point for correct answer.
 -0.25 for incorrect rounding.

4. Milton owes \$45,500 in student loans. His loan has an APR of 5.2% compounded monthly.
- (a) (3 points) Assume Milton wants to pay off the loan in 10 years. What would be his monthly payment? Round to the nearest penny.

Answer:

$$PMT = \frac{45,500 \times \left(\frac{0.052}{12}\right)}{\left[1 - \left(1 + \frac{0.052}{12}\right)^{(-12 \times 10)}\right]} \approx \$487.06$$

1 point for use of correct formula.
 1 point for values in correct places in formula.
 0.5 point for correct computation.
 0.5 point for correct answer.
 -0.25 for incorrect rounding.

- (b) (2 points) Now assume that he wishes to pay off the loan in 8 years instead. What would be his monthly payment in this case? Round to the nearest penny.

Answer:

$$PMT = \frac{45,500 \times \left(\frac{0.052}{12}\right)}{\left[1 - \left(1 + \frac{0.052}{12}\right)^{(-12 \times 8)}\right]} \approx \$580.37$$

1 point for values in correct places in formula.
 0.5 point for correct computation.
 0.5 point for correct answer.
 -0.25 for incorrect rounding.

- (c) (3 points) Calculate Milton's savings from paying off the loan early.

Answer:

10 years: Total = $487.06 \times 12 \times 10 = \$58,447.20$

8 years: Total = $580.37 \times 12 \times 8 = \$55,715.52$

Savings: $58,447.20 - 55,715.52 = \$2,731.68$

1 point for correct set up of total expenditures computations.
 0.5 point for total expenditures computation for each loan.
 0.5 point for subtracting the two total expenditures.
 0.5 point for correct answer.

5. An election with 3 candidates is held. The following preference schedule is collected.

1 st	Abner	Lyndsey	Fiona
2 nd	Lyndsey	Fiona	Lyndsey
3 rd	Fiona	Abner	Abner
Total	41	35	24

In each question below, make sure to show work or give an explanation to support your answer.

- (a) (2 points) Find the winner of the election by the plurality method.

Answer:

Abner has the most first place votes, so Abner wins by plurality.

1 point for correct answer.
1 point for explanation/work.

- (b) (2 points) Find the winner of the election by single (top-two) runoff.

Answer:

Abner and Lyndsey have the most first place votes, so Fiona is eliminated. Comparing Abner and Lyndsey in each column, Abner beats Lyndsey in column 1 for 41 votes, but Lyndsey beats Abner in columns 2 and 3 for a total of $35 + 24 = 59$ votes. Therefore, Lyndsey wins by single runoff.

1 point for correct answer.
1 point for explanation/work.

- (c) (3 points) Find the winner of the election by Borda Count method.

Answer:

$$\begin{aligned} \text{Abner} &: (41 \times 3) + (35 \times 1) + (24 \times 1) = 182 \\ \text{Lyndsey} &: (41 \times 2) + (35 \times 3) + (24 \times 2) = 235 \\ \text{Fiona} &: (41 \times 1) + (35 \times 2) + (24 \times 3) = 183. \end{aligned}$$

This shows that Lyndsey wins by Borda count method since she secured the most points.

0.5 point for correct use/structure of Borda count method.
0.5 point each for work and correct point totals for each person.
1 point for correct winner of election.

6. (2 points) Follow all testing protocol directions (hold up blank paper to the webcam at the beginning of the exam; show your work to the webcam before submitting; etc.).

Each violation worth 1 or 2 points at discretion of grader, for a maximum of 2 points.

Grading notes for entire FR section:

Alternative solutions, if mathematically sound and otherwise appropriate for the problem, are accepted without penalty.

Minor deductions are the discretion of the grader; deductions can come in increments of 0.25.

If a problem needs the use of an answer from a previous part, then correct work using incorrect previous answers still earns credit.

Formulas

- **Area** = length \times width
- **Volume** = length \times width \times height
- **Density** = $\frac{\text{mass}}{\text{volume}}$
- **Population Density** = $\frac{\text{people}}{\text{area}}$
- **Absolute Change** = new value - old value
- **Absolute Difference** = compared value - reference value
- **Relative Change** = $\frac{\text{new value} - \text{old value}}{\text{old value}} \times 100\%$
- **Relative Difference** = $\frac{\text{compared value} - \text{reference value}}{\text{reference value}} \times 100\%$
- **Index Number:** $\frac{\text{compared value}}{\text{reference value}} \times 100$
- **CPI:** $\text{Price in } \$_y = (\text{Price in } \$_x) \times \left(\frac{CPI_y}{CPI_x}\right)$ or $\frac{CPI_y}{CPI_x} = \frac{\text{Price in } \$_y}{\text{Price in } \$_x}$
- **Rate of Inflation:** $\frac{CPI_{New} - CPI_{Old}}{CPI_{Old}} \times 100\%$

TABLE 3.4 Average Annual Consumer Price Index (1982–1984 = 100)

Year	CPI	Year	CPI	Year	CPI	Year	CPI
1977	60.6	1987	113.6	1997	160.5	2007	207.3
1978	65.2	1988	118.3	1998	163.0	2008	215.3
1979	72.6	1989	124.0	1999	166.6	2009	214.5
1980	82.4	1990	130.7	2000	172.2	2010	218.1
1981	90.9	1991	136.2	2001	177.1	2011	224.9
1982	96.5	1992	140.3	2002	179.9	2012	229.6
1983	99.6	1993	144.5	2003	184.0	2013	233.0
1984	103.9	1994	148.2	2004	188.9	2014	236.7
1985	107.6	1995	152.4	2005	195.3	2015	237.0
1986	109.6	1996	156.9	2006	201.6	2016	240.0

- **Simple Interest:** $A = P + (P \times APR \times Y)$
- **Compound Interest:** $A = P \left(1 + \frac{APR}{n}\right)^{(nY)}$

$$P = \frac{A}{\left(1 + \frac{APR}{n}\right)^{(nY)}}$$

$$A = P \times e^{(APR \times Y)} \quad P = \frac{A}{e^{(APR \times Y)}}$$
- **APY = Total Return:** $\frac{A - P}{P} \times 100\%$

• **Savings Plans:** $A = PMT \times \left[\frac{\left(1 + \frac{APR}{n}\right)^{(nY)} - 1}{\left(\frac{APR}{n}\right)} \right]$ $PMT = \frac{A}{\left[\frac{\left(1 + \frac{APR}{n}\right)^{(nY)} - 1}{\left(\frac{APR}{n}\right)} \right]}$

• **Annual Return:** $\left[\left(\frac{A}{P}\right)^{\left(\frac{1}{Y}\right)} - 1 \right] \times 100\%$

• **Installment Loans:** $PMT = \frac{P \times \left(\frac{APR}{n}\right)}{\left[1 - \left(1 + \frac{APR}{n}\right)^{(-nY)} \right]}$ $P = \frac{PMT \times \left[1 - \left(1 + \frac{APR}{n}\right)^{(-nY)} \right]}{\left(\frac{APR}{n}\right)}$

- **Gross Income**= Sum of All Income
- **Adjusted Gross Income**= Gross Income – Adjustments to Income
- **Taxable Income**= Adjusted Gross Income – (Deductions and Exemptions)
- **Total Income Tax**= Tax Calculated from Table – Tax Credits
- **Overall Federal Tax Rate**= $\frac{\text{Total Income Tax} + \text{FICA Tax}}{\text{Gross Income}} \times 100\%$

Tax Rate*	Single	Married Filing Jointly	Married Filing Separately	Head of Household
10%	Up to \$9,875	Up to \$19,750	Up to \$9,875	Up to \$14,100
12%	Up to \$40,125	Up to \$80,250	Up to \$40,125	Up to \$53,700
22%	Up to \$85,525	Up to \$171,050	Up to \$85,525	Up to \$85,500
24%	Up to \$163,300	Up to \$326,600	Up to \$163,300	Up to \$163,300
32%	Up to \$207,350	Up to \$414,700	Up to \$207,350	Up to \$207,350
35%	Up to \$518,400	Up to \$622,050	Up to \$311,025	Up to \$518,400
37%	Above \$518,400	Above \$622,050	Above \$311,025	Above \$518,400
Standard Deduction	\$12,200	\$24,400	\$12,200	\$18,350
Exemption (per person)	\$0	\$0	\$0	\$0