ECON 180 FALL 2022: PROJECT 4

DUE November 22, 2022 by 11:59 PM VICTORIA, B.C. TIME

Honor Code: I guarantee that this submission is **entirely my own work**. I have **cited any outside sources** in APA or IEEE style. **(You must accept this code to receive a mark.)**

Name or Signature for Honor Code: Arfaz Hossain

Last 3 digits of student number: 826

Please enter your answers in the spaces and tables provided. Your submission must be in either PDF or Microsoft 365 (Word, etc.) format, so Brightspace can read it properly.

Question		Marks
1	a-b	75 each
	Q1 (Average)	75
2	A - f	75 each
	Q2 (Average)	75
Q1 to Q2	(Q1 + Q2)/2	75
3	a	3
	b	3
	c	4
	Q3 (Total)	10
4	Q4 (All)	5
Subtotal	(Q1 to Q2)+Q3+Q4	90
Communication		10
Total		Max 100

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Question 1: Inflation (Lectures 22, 23)

1.a. Using the CPI (Lecture 22)

i. The Canadian CPI was 11.5 in September 1920 and is 152.7 in September 2022. Calculate the average annual rate of inflation from 1920 to 2022 (102 years). Show your work.

Average annual rate of inflation: 12.0375% per year

The formula I'm using =>

$$\left[\left(\frac{YearN\ Index}{BaseYear\ Index}\right)^{\frac{1}{Total\ Years}} - 1\right] = \left[\left(\frac{152.7}{11.5}\right)^{\frac{1}{102}} - 1\right] = 0.02567834922\ or\ 2.56783\%$$

ii. In Calgary, in 1920, a dozen eggs cost[1] $0.50. In Calgary, in November 2022, a dozen Great Value Large Eggs cost $3.88 at Walmart. Use the CPI information from part i. to determine whether the price of eggs has gone down, gone up, or stayed the same in real terms (after adjusting for inflation). Show your work and briefly explain your reasoning. **Hint: If you want to check your math, you can try using the Bank of Canada's inflation calculator: https://www.bankofcanada.ca/rates/related/inflation-calculator/ Just keep in mind the 2022 CPI may be slightly different from the above if they update the CPI figures while this assignment is in progress.**

The price of eggs in Calgary has fallen in real terms, from 1920 to 2022.

$$\left[0.50 \times \frac{152.7}{11.5}\right] = \$6.639130\ or, \$6.64$$

Since the current price is $3.88, whereas it is $6.64 adjusted by inflation, the price has gone down.

[1] "My weekly budget of Prices" by CAREFUL HOUSEKEEPER. In Willmore, C. (2020). Woman's Sphere of Action: Canadian women, housework and the household, 1858-1921. Victoria: Skeride Publishing. Available for free at https://onlineacademiccommunity.uvic.ca/willmore/wp-content/uploads/sites/5845/2022/01/sphereofactionv1.pdf

1.b Inflation and present values (Lecture 23)

Suppose that:

- Mandeep has decided to live and work in Montreal
- Mandeep's *nominal* MARR is 5.45% per year.
- Yearly inflation is the rate which you calculated[2] in part 1.a.
- Month 0 is the base month for inflation calculations, AND the 'present' for present value calculations.
- Mandeep's monthly rent is constant in real terms, at the baseline level from Project 1. (If your baseline rent for Montreal was $2,000 a month, then Mandeep's rent is constant in real terms at $2,000 base year dollars per month.)
- Mandeep pays rent for 40 years (480 months). The first rent payment is in month 36.

i. Calculate the present value of Mandeep's rent using *nominal* cash flows and *nominal* rates. Show your work. (You're being graded on *how* you obtained the present value, not on the final numerical answer per se.)

Present Value of Rent: $399,292.01

Since the actual rent starts from Month 36 and runs until Month 480, we turn all the arithmetic gradient sequences of rentals from these periods to Month 36, and then to the left side of the timeline, to Month 0 in Project 2. Now, we have an equally distributed annuities throughout the period Month 0 to Month 480 of an amount $2000.

Inflation Rate, F_{yearly}	= 2.57%/year or, 0.2116846223%
	≈ 0.21%/month
A, Annuity of rentals	= $2000
$MARR_{nominal}$	= 5.45%/year or, 0.4432019219%
	≈ 0.44%/month
Total Months, N	= 40 Years, 480 Months

Using **A×(P/A,i,N)** Present Worth (PW) = $399,292.01

[2] If you skipped that question, assume that inflation is 2% per year. That's the Bank of Canada's usual inflation target.

ii. Calculate the present value of Mandeep's rent using *real* cash flows and *real* rates. Show your work. (You're being graded on *how* you obtained the present value, not on the final numerical answer per se.)

(Hint: Since Month 0 is both the present AND the base month for inflation calculations, your numerical results should be identical for parts i. and ii. If they're not, that's a sign that you should re-check your setup and calculations.)

Present Value of Rent: $399240.2852

Using the formula:

$$Present\ Worth, PW = \sum_{i=0}^{Total\ Duration} \left[\frac{Total\ Capital\ Flow}{((1 + Real\ Interest\ Rate) \times (1 + Inflation\ Rate))^{Total\ Duration}} \right]$$

Years	Present Worth
0	2000
1	1991.175074
2	1982.389087
3	1973.641869
4	1964.933247
5	1956.263051
6	1947.631113
7	1939.037262
8	1930.481332
9	1921.963154
10	1913.482563
11	1905.039392
12	1896.633476
13	1888.26465
14	1879.932752
15	1871.637618
16	1863.379086
17	1855.156995
18	1846.971183
19	1838.821491
20	1830.707759
21	1822.629829
22	1814.587542
23	1806.580741
24	1798.60927
25	1790.672973
26	1782.771695
27	1774.905281
28	1767.073577
29	1759.27643
30	1751.513687
31	1743.785198
32	1736.09081
33	1728.430373

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451	272.1839699
452	270.9829682
453	269.7872658
454	268.5968395
455	267.4116658
456	266.2317217
457	265.0569841
458	263.8874299
459	262.7230364
460	261.5637807
461	260.4096402
462	259.2605922
463	258.1166144
464	256.9776844
465	255.8437798
466	254.7148786
467	253.5909586
468	252.4719979
469	251.3579745
470	250.2488667
471	249.1446528
472	248.0453112
473	246.9508204
474	245.8611591
475	244.7763058
476	243.6962393
477	242.6209387
478	241.5503827
479	240.4845506
480	239.4234214

Inflation Rate Monthly	0.21%
Capital	2000
Nominal MARR	0.44%
Real MARR	0.23%
Rates	1.004432019

Rates = ((1+Real Interest Rate) × (1+Inflation Rate)) = 1.004432019; Total Duration = 480 Months
All rates are calculated monthly.

Adding all the present worth values from yearly basis, we get $399,240.2852 ≈ $399,292.01 *from Question 1b(i)*.
The difference in the numerical results can be explained with the approximation errors in my calculations, perhaps.

Question 2: Sensitivity Analysis (Lectures 24 – 26)

For Question 2, you're going to be asked to perform sensitivity analyses on the various values you calculated in Project 2 (mostly present values of income and housing).

Although it does not introduce any new material, Lecture 27, on performing one-sided sensitivity calculations in Excel, may be helpful.

2.a Scenario Analysis (Lecture 24)

Your value of interest is the present value of working and buying a house in Regina. From Project 2, we know the relevant formulas are as follow:

NPV_{Regina} = (PV of Income) – (PV of Housing)

PV of Income = (S/4) x (P/F,MARR,3) + S x (P/A,g,MARR,40) x (P/F,MARR,2)

PV of Housing = H x (A/P,$B_{monthly}$,300) x (P/A,$MARR_{monthly}$,300) x (P/F,$MARR_{monthly}$,35)

- S = (Starting) yearly salary in Regina (this is the 'salary' value you found in Project 1)
- MARR = 5.45% (per year)
- g = 3.5% each year (yearly growth in salary).
- H = Price of a house in Regina
- $B_{monthly} = (1 + (APR/2))^{1/6} - 1$; this is the monthly version of the interest rate charged by the bank on the mortgage.
- APR = APR on the mortgage (which is compounded every 6 months)
- $MARR_{monthly} = (1+5.45\%)^{1/12} - 1$

You will notice that since the MARR is given, this is a function of only three parameters, S (starting yearly salary), H (price of a house in Regina) and the APR corresponding to Mandeep's mortgage.

Fill out the following table using the values you obtained in Project 1 (or values from the Project 1 key if you didn't complete Project 1). For each of the parameters listed, explain whether you are using the minimum, the baseline or the maximum value. (This is already filled out for the baseline case.)

Assume that the minimum/maximum/baseline values from Project 1 are for the *starting salary*, S.

To make it simple for the TAs to mark, in the yellow cells, please write whether the parameter values you are using in each case are the minimum, maximum or baseline (the trivial baseline case is filled out for you).

NPV of Living & Working in Regina: Baseline, Worst Case & Best-Case Scenarios

	Scenario	Worst Case	Baseline	Best Case
	PV Housing			
Values	S	48,000	76,255	90,000
	H	1,690,000	889,900	565,756
	APR	7.00%	6.140%	6.020%
Are you using the MAX, MIN or BASELINE value of the parameter for this scenario?	S	MINIMUM	BASELINE	MAXIMUM
	H	MAXIMUM	BASELINE	MINIMUM
	APR	MAXIMUM	BASELINE	MINIMUM

Hints: "Worst Case" = lowest possible NPV, given the minimum & maximum values of your parameters.

MARR	0.44%						
				P1	P2	P3	P4
S1	48000		PV(INCOME) W	$11,841.85	3638875.458	$3,606,833.50	$3,618,675.35
S2	76255		PV(INCOME) Ba	$18,812.51	6288869.905	$6,288,869.91	$6,307,682.41
S3	90000		PV(INCOME) Be	$22,203.47	7609524.997	$7,609,525.00	$7,631,728.47
H1	1690000		PV(HOUSING) W	$11,837.03	$1,962,074.84	$1,680,723.86	
H2	889900		PV(HOUSING) Ba	$3,966.98	$657,556.05	$563,266.05	
H3	565756		PV(HOUSING) Be	$2,184.05	$362,022.06	$310,110.04	
APR O1	0.58%						
APR O2	0.20%						
APR O3	0.10%	Column1	WORST	BASE	BEST		
		INCOME	$3,606,833.50	$6,307,682.41	$7,631,728.47		
		HOUSING	$1,680,723.86	$563,266.05	$310,110.04		

2.b Switching Values (Lecture 25)

Using the same formula for NPV as in 2.a, calculate the switching values for S, H and APR. Report them two ways: in natural units ($ for S, H, and % for APR), and as % deviation from baseline. Show your work. Since every student will have slightly different numbers, you're being graded on the *process* of how you obtained the answers.

Hint: If your switching value for S is $250, and your baseline S is $100, then the switching value is equal to a +150% deviation from baseline. (Baseline of $100 + 150% x Baseline of $100 = $250).

Some switching value calculations may be analytically intractable – **feel free to use numerical methods, Wolfram Alpha, Excel's GoalSeek, etc. to find your numerical answers**. You can still show your work, for example, by explaining what you did in Excel, or by providing the formula you entered into Wolfram Alpha, and then saying you used Wolfram Alpha to solve it.

Switching values for the NPV of living and working in Regina

	Parameter	Natural Units	% Deviation from Baseline
Switching Values for NPV of living & working in Regina	S	$7471.455111	-0.9%
	H	$9,082,477.709	10.21%
	APR	-%	-

Show your work/explain your process below.

NPV_{Regina} = (PV of Income) – (PV of Housing)

Calculating the NPV from the worst, baseline, and best-case scenarios, we can get the NPVs of all three together here.

Original:

MARR	0.44%							
				P1	P2	P3	P4	
S1	48000		PV(INCOME) W	$11,841.85	3638875.458	$3,606,833.50	$3,618,675.35	
S2	76255		PV(INCOME) Ba	$18,812.51	5780884.335	$5,729,981.01	$5,748,793.52	
S3	90000		PV(INCOME) Be	$22,203.47	6822891.484	$6,762,812.81	$6,785,016.28	
H1	1690000		PV(HOUSING) W	$11,837.03	$1,962,074.84	$1,680,723.86		
H2	889900		PV(HOUSING) Ba	$3,966.98	$657,556.05	$563,266.05		
H3	565756		PV(HOUSING) Be	$2,184.05	$362,022.06	$310,110.04		
APR O1	0.58%						NPV W	$1,937,951.49
APR O2	0.20%						NPV Ba	$5,185,527.47
APR O3	0.10%	Column1	WORST	BASE	BEST		NPV Be	$6,474,906.24
		INCOME	$3,606,833.50	$5,748,793.52	$6,785,016.28			
		HOUSING	$1,680,723.86	$563,266.05	$310,110.04			

Changing NPV=0 keeping APR and HOUSING as base cases:

			CHANGING FIRST SALARY						
	MARR	0.44%							
					P1	P2	P3	P4	
	S1	22293.9992		PV(INCOME) W	$5,500.05	1690105.967	$1,675,223.81	$1,680,723.86	
	S2	7471.45511		PV(INCOME) Ba	$1,843.25	566410.305	$561,422.80	$563,266.05	
	S3	4113.46157		PV(INCOME) Be	$1,014.81	311841.1327	$309,095.23	$310,110.04	
	H1	1690000		PV(HOUSING) W	$11,837.03	$1,962,074.84	$1,680,723.86		
	H2	889900		PV(HOUSING) Ba	$3,966.98	$657,556.05	$563,266.05		
	H3	565756		PV(HOUSING) Be	$2,184.05	$362,022.06	$310,110.04		
	APR O1	0.58%						NPV W	$0.00
	APR O2	0.20%						NPV Ba	$0.00
	APR O3	0.10%	Column1	WORST	BASE	BEST		NPV Be	$0.00
			INCOME	$1,675,223.81	$563,266.05	$310,110.04			
			HOUSING	$1,680,723.86	$563,266.05	$310,110.04			

Changing NPV=0 keeping APR and INCOME as base cases:

			CHANGING HOUSING						
	MARR	0.44%							
					P1	P2	P3	P4	
	S1	48000		PV(INCOME) W	$11,841.85	3638875.458	$3,606,833.50	$3,618,675.35	
	S2	76255		PV(INCOME) Ba	$18,812.51	5780884.335	$5,729,981.01	$5,748,793.52	
	S3	90000		PV(INCOME) Be	$22,203.47	6822891.484	$6,762,812.81	$6,785,016.28	
	H1	3638647.31		PV(HOUSING) W	$25,485.66	$4,224,436.88	$3,618,675.35		
	H2	9082477.71		PV(HOUSING) Ba	$40,487.69	$6,711,134.05	$5,748,793.52		
	H3	12378392		PV(HOUSING) Be	$47,785.61	$7,920,819.15	$6,785,016.28		
	APR O1	0.58%						NPV W	$0.00
	APR O2	0.20%						NPV Ba	$0.00
	APR O3	0.10%	Column1	WORST	BASE	BEST		NPV Be	$0.00
			INCOME	$3,606,833.50	$5,748,793.52	$6,785,016.28			
			HOUSING	$3,618,675.35	$5,748,793.52	$6,785,016.28			

2.c Tornado Graph (Lecture 24)

Create a Tornado Diagram for the net present value of living and working (earning salary & paying rent) in Victoria. Assume that the minimum/maximum/baseline values for salary from Project 1 are for the *first year's salary, S.*

Your value of interest is the present value of working and paying for a garden suite near Victoria. From Project 2, we know the relevant formulas are as follow:

NPV = (PV of Income) – (PV of Housing)

PV of Income = (S/4) x (P/F,MARR,3) + S x (P/A,g,MARR,40) x (P/F,MARR,2)

PV of Housing =

($10,000 + (G - $10,000) x (A/P,$i_{monthly}$,60) x (P/A,$MARR_{monthly}$,60)) x (P/F,0. $MARR_{monthly}$,35)

- S = (Starting) yearly salary in Victoria (this is the 'salary' value you found in Project 1)
- MARR = 5.45% (per year)
- g = 3.5% (per year)
- G = Cost of garden suite (from Project 1)
- $i_{monthly} = (1 + 18\%)^{1/12} - 1$
- $MARR_{monthly} = (1+5.45\%)^{1/12} - 1$

You will notice that this is a function of only two parameters, S (starting yearly salary), and G (cost of a garden suite).

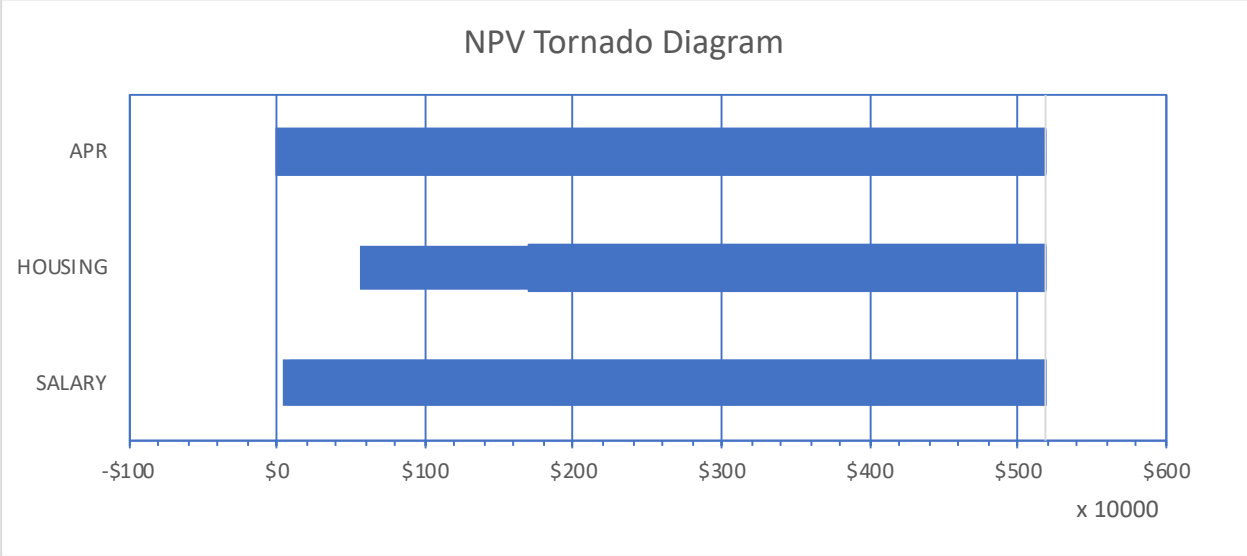
TAs will be checking for the following:

- Widest bars at the top, narrowest bars at the bottom.
- Vertical line through the baseline value.
- Properly labeled axes.
- One bar for each of S,G
- (Optional) Data labels on either side of each bar.
- (Optional) Uniform colour for the bars.

IF YOU'RE NOT COMFORTABLE WITH EXCEL, IT'S FINE TO DO THIS BY HAND AND SUBMIT, e.g. A SCAN OR CELL PHONE PHOTO OF YOUR GRAPH.

[INSERT YOUR TORNADO GRAPH ABOUT HERE – PLEASE DO NOT JUST COPY AND PASTE FROM EXCEL, AS THAT MAY BREAK THE IMAGE! COPY FROM EXCEL AND 'PASTE SPECIAL', PREFERABLY AS PDF, PNG, GIF, JPG OR TIFF]

	WORST	BASE	BEST
S	48000	76255	90000
H	1690000	889900	565756
APR	0.58%	0.20%	0.10%
NPV	$1,937,951.49	$5,185,527.47	$6,474,906.24
Sensitivities	SALARY	HOUSING	APR
NPV Low	$48,000.00	$565,756.00	0.10%
NPV High	$90,000.00	$1,690,000.00	0.58%



2.d Spider Diagram (Lecture 24)

Create a Spider Diagram for the present value of living and working (earning salary, paying rent) in Montreal. Assume that the minimum/maximum/baseline values from Project 1 are for the *first year's salary,* S.

The relevant equation is the same as before. This present value is represented by the following equation:

Your value of interest is the present value of working and renting a home in Montreal. From Project 2, we know the relevant formulas are as follow:

NPV = (PV of Income) – (PV of Housing)

PV of Income = (S/4) x (P/F,MARR,3) + S x (P/A,g,MARR,40) x (P/F,MARR,2)

PV of Housing = R x (P/A,$MARR_{monthly}$,480) x (P/F,$MARR_{monthly}$,35)

- S = (Starting) yearly salary in Montreal (this is the 'salary' value you found in Project 1)
- MARR = 5.45% (per year)
- g = 3.5% (per year)
- R = Monthly rent (from Project 1)
- $MARR_{monthly} = (1+5.45\%)^{1/12} - 1$

You will notice that this is a function of only two parameters, S (starting yearly salary), and R (monthly rent).

Write down your MIN and MAX values of your parameters in terms of % deviation from baseline.

MIN AND MAX PARAMETER VALUES IN % DEVIATION FROM BASELINE

	MIN	MAX
S	-13.34%	53.83%
R	-43.15%	25.00%

Parameters used:

	WORST	BASE	BEST
S	63500	73277	112719
H	90964	160000	200000

TAs will be checking for the following:

- Axes are properly labeled
- Plots only extend over the allowed range.
- The entirety of each plot is visible (not zoomed in).
- X-axis units are % deviation from baseline.
- All plots cross at 0% deviation from baseline.
- The vertical endpoints of your plots correspond to the bar endpoints of your tornado diagram (since they should be showing the same thing: the value when all parameters except one are at their baseline levels, and that remaining parameter taxes on its MAX or MIN values).

INSERT YOUR SPIDER DIAGRAM ABOUT HERE – PLEASE DO NOT JUST COPY AND PASTE FROM EXCEL, AS THAT MAY BREAK THE IMAGE! COPY FROM EXCEL AND 'PASTE SPECIAL', PREFERABLY AS PDF OR TIFF. IF YOU'RE NOT COMFORTABLE WITH EXCEL, IT'S FINE TO DO THIS BY HAND AND SUBMIT, e.g. A SCAN OR CELL PHONE PHOTO OF YOUR GRAPH.

2.e Interpretation (Lectures 24 – 26)

This is intended as a low-stress, "easy" (but important) question to give you a bit of a rest before moving on with the rest of the project.

i. Based on your answers to parts 2.a – 2.d, which parameters were your NPVs most sensitive to? List one parameter for each city (Regina, Victoria, Montreal), and briefly justify your choice. For full marks, this justification should arise from something you saw in your diagrams and tables (e.g. width of a tornado 'bar').

[Write your answer here]

ii. If you were offered the time and resources to reduce the uncertainty in just *one* parameter (e.g. starting yearly salary in Regina), which parameter would you choose, and why? Briefly explain your reasoning. For full marks, you should base your reasoning on something you saw in your diagrams and/or tables from parts 2.a – 2.d.

[Write your answer here]

2.f Decision Trees (Lecture 26)

In this question, you're asked to put together a decision tree based on information from

Wall, K., Zhao, J., Ferguson, S. & Rodriguez, C. (2018). Results from the 2016 Census: Is field of study a factor in the payoff of a graduate degree? [Web Page]. https://www150.statcan.gc.ca/n1/pub/75-006-x/2018001/article/54978-eng.htm

For this question, you don't have to worry about the time value of money, inflation or taxes. This is intended to be a simple question that tests your ability to create and interpret simple decision trees (and nothing else).

Alex is a non-binary student about to finish high school. They are considering an engineering degree (or two, or three). The *only* thing they are concerned about right now is their potential yearly income (they're ignoring tuition fees, etc.), and they've come up with the following:

- Right now, they need to **choose** whether to go for a bachelor's degree or get a job immediately after high school. If they get a job immediately, they will earn $36,000 a year (StatCan's value for the median Canadian income as of 2016, the same year as the other figures in this problem).
- If Alex gets a bachelor's degree, they can **choose** to stop at a bachelor's degree or go on for a master's degree.
- If Alex stops at a bachelor's degree, there is a 47% **chance** they will work as an engineer and earn income of $105,200 per year. The other 53% of the time, they will *not* be able to work as an engineer, despite their degree, and will earn $36,000 a year.
- If Alex get's a master's degree, they can **choose** to stop at a master's degree or go on for a PhD.
- If Alex stops at a master's degree, there is a 51% **chance** they will work as an engineer and earn income of $105,100 per year[3]. The other 49% of the time, they will *not* be able to work as an engineer, despite their degree, and will earn $36,000 a year.
- If Alex gets a PhD, there is a 37% **chance** they work as an engineer, earning $108,500 per year, a 25% chance they work as a professor, earning $127,700 per year, and a 38% chance they will not work as either an engineer or a professor, and will earn $36,000 a year.

[3] Yes, this is slightly lower than the $150,200 earned by someone with a bachelor's degree. That's true to the original source (Statistics Canada).

i. Draw a decision tree representing the situation facing Alex. There should be three square 'choice' nodes, three round 'chance' nodes, and eight terminal nodes representing all possible outcomes. (Hint: the choice node at the very left of the tree should be 'Stop at High School or get a Bachelor's Degree?')

[Insert Decision Tree Here – a phone photo of a freehand drawing is fine, or you could use a drawing program, Powerpoint, etc. and paste the resulting image as a GIF, JPG, PNG, etc.]

ii. Assume Alex is risk neutral (makes decisions based on mathematical expected value), and when having to make a choice, will choose a higher expected income over a lower expected income. Use your decision to calculate Alex's expected income. Show your work.

Expected Income: _____ a year

[Show your work]

Question 3 (Challenge) Building a Price Index (Lecture 23) (10 marks)

In early 1920, Edmonton's Local Council of Women sounded the alarm regarding the low wages earned by waitresses (the serving profession was heavily gendered – waitresses were officially paid less than waiters[4], and this wouldn't start to change until the late 1960s[5]). The Edmonton Journal for October 12, 1920 reports this as follows:

"It was […] disclosed, according to the statement of Mrs. W. J. Ross, secretary of the Local Council of Women, that some waitresses are dependent on the tips they receive for necessary clothing expenses. A girl paid $9 a week as a waitress had to use the whole sum for room rent, laundry, week-end meals and incidentals. She received her meals for five days of the week at the place of employment. Other expenses, such as clothing, amounted to $260 a year. From tips she received $5.25 a week, and with this money she obtained what clothing she could. […]

Mrs. W. J. Ross produced a statement showing the weekly costs incurred by a waitress. In one case a girl, on a salary of $9, had to pay $4 for a room, $1 for laundry, $2 for the week-end meals between Saturday and Monday, $1 for carfare and $1 for sickness charges.

In one case a girl had not had a new suit for four years, said Mrs. Ross. In another case a head waitress who received $18 a week was assisting to support her mother.

"Do you know if an increase in the minimum wage an effect on the tipping system would have?" asked Mr. Martin.

Mrs. Ross replied that many people know the position the girls are in, and tip them on that account."[6]

That breakdown of weekly spending just happens to be *perfect* for using as the basket of a Laspeyres price index – and that's what you're going to do in this question.

[4] "One of the oldest waiters in the city [of Toronto], who has gone the rounds, having been employed at one time or another in almost every café and hotel of any importance in the city, and in Canada, places the prevailing average rate of wages paid waiters, waitresses, and domestics about as follows: Waiters, hotels, per week, $6 to $7; waiters, clubs, per month, $20 to $25; waiters, clubs, summer months, $30; waitresses, cafes, per month, $12 to $15; domestics, per month, $10 to $20." From WANT ADVANCED WAGES. (1904, October 14). *The Globe,* p. 4.

[5] "A recent Ontario Supreme Court ruling decided that there is no difference between men and women – at least where waiters are concerned. Mr. Justice Alexander Stark ruled that Marina Trepanier, a lounge waitress in a Sault Ste. Marie hotel, was not a waitress but a female waiter and should be paid accordingly." From Court rules waitress a waiter in practice. (1968, August 28). *The Windsor Star*, p. 4. For more information, see the appendix.

[6] From MINIMUM WAGE MEANS LETTING CLERKS GO. (1920, October 12). *The Regina Journal,* p. 1.

3.a. The basket in 1920 and 2022 (3 marks)

(3 marks) Fill out the following table with appropriate values for 2022 and cite your sources. Ideally, you should find Edmonton values, so that you can compare them to the values obtained in Edmonton in 1920, but values from other places in Canada (e.g., Victoria) are also allowed, if you find those numbers easier to get.

Item	1920 Cost	2022 Cost
Rent (1 week, 1 room)	$4	$491.63
Laundry (1 week)	$1	$3.00
Meals (2 days)	$2	$30.00
Transportation (1 week)	$1	$10.50
Health care (1 week)	$1	$17.50

You are trying to find values that are appropriate for a person working full-time as a server in Edmonton (or, if you prefer, Victoria) in 2022. **Please don't spend hours on this unless you really want to. Rough values are fine. I expect/hope students will spend no more than 25 minutes on this (5 minutes per item), and some students may finish in 5 minutes and receive full marks.**

Rent: One week's worth of rent for a room (studio apartment, room in a larger house, etc.) within commuting distance of major restaurants, where our server works. It's fine to divide a monthly rent by 4 to obtain this value.

Laundry: One week's worth of laundry costs. This may be as small as the cost of a fraction of a bottle of laundry detergent, if the rented room has its washer/dryer and water and electricity included, or it may be the cost of using a coin laundry, plus a bit of detergent, etc., and some dry cleaning for certain kinds of uniform our server wears at work.

Meals: You should only include the cost of *two days' worth of meals*. (In 1920, this was because our server was expected to eat at work, for "free", 5 days out of 7.)

Transportation: The original had 'car fare', but this may be the cost of bus tickets, a bus pass (divide the cost of a monthly bus pass by 4 to get a weekly bus pass), cost of gas if our server owns a car, etc.

Health care: Whatever you think is appropriate for someone in the serving profession. Since it *is* 2022, this may include necessary spending on masks and PPE.

Please write down any necessary calculations here (e.g., if you divided a monthly room rent by 4 to get a weekly room rent, or multiplied the cost of a Big Mac combo by 6 to get the cost of 2 days' worth of meals):

Rental Weekly = 2107/month or, 491.63/week[1]
Laundry Spending = 3.00 (Based on my personal estimate)
Meals (2-days) = $30 (Based on my personal estimate)
Transportation (weekly) = $45/month (Bus Pass) = 10.5/week[2]
Health Care (weekly) = $75/month = $17.5/week[3]

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[1] "Average Rent in Victoria, BC and Cost Information" ***Zumper*** - *Apartments for Rent & Houses*. https://www.zumper.com/rent-research/victoria-bc
[2] "BC Transit - Fares - Victoria," ***BCTransit***. https://www.bctransit.com/victoria/fares
[3] "Health Insurance BC: Summary of Benefits and Coverage," ***HealthQuotes***. https://healthquotes.ca/provincial-insurance-plans/health-insurance-bc/

3.b Calculating the Index (3 marks)

(3 marks) Use the information from part a. to calculate a Laspeyres price index for 2022, using 1920 as the base year. Show your work.

Laspeyres price index for 2022: 6144.4444%

L_{2020} = (Sum of all *Products*×*Quantites* for 2020) / (Sum of all *Products*×*Quantites* for 1920) × 100
= ($491.63×1 + $3.00×1 + $30×1 + $10.5×1 + $17.5×1) / ($4×1 + $1×1 + $2×1 + $1×1 + $1×1) × 100
= $552.63 / $9 × 100
= 61.40333 × 100
= 6140.33333.

Inflation Rate = (6140.44-100)/100 = 60.44%

3.c Comparison to the CPI (4 marks)

i. (2 marks) The Canadian CPI was 11.5 in 1920, and is 152.7 in 2022. Is average yearly inflation, calculated your Laspeyres index, greater than, less than or equal to average yearly inflation calculated using the CPI? Show your work.

Inflation is 60.44% when calculated using my Laspeyres index, compared to the inflation calculated using the CPI.

Inflation Rate = (6144.44-100)/100% = 60.44%

ii. (2 marks) *Why* do you think that the two 'average yearly inflation' rates differed in the way you described in 4.c.i? If inflation using your index was higher than the one found using the CPI, why? If inflation using your index was lower than the one found using the CPI, why? (Hint: You may wish to look at the CPI basket weights[7] used by Statistics Canada.)

My inflation value is much higher than the annual inflation rate from 1920 to 2020. I think one of the reasons might be that the Laspeyres Index tends to overstate the cost of living and considers the living standards and rentals. Whereas CPI doesn't have a criterion for living in their basket weights, which in-turn doesn't consider the rental market.

[7] Statistics Canada's summary of CPI basket weights:
https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000701

Question 4 (Challenge) Interest Rates & Inflation (5 marks)

Interest rates and inflation have been featured heavily in the news recently. The Bank of Canada has been very clear about the fact that it is intentionally raising interest rates, to counter inflation. From a press release[8] dated October 26, 2022:

"The Bank of Canada today increased its target for the overnight [interest] rate to 3¾%, with the Bank Rate at 4% and the deposit rate at 3¾%. […] The Bank expects CPI inflation to ease as higher interest rates help rebalance demand and supply, price pressures from global supply disruptions fade, and the past effects of higher commodity prices dissipate. CPI inflation is projected to move down to about 3% by the end of 2023, and then return to the 2% target by the end of 2024."

-Bank of Canada

Using what you have learned throughout this course about the MARR, opportunity cost, supply and demand, inflation, etc., briefly explain why raising interest rates can lower inflation:

[Write your answer here, **in from 5 to 750 words**. For full marks, it should be clear that you are using insight gained from ECON 180 material to answer the question, and that you have an excellent understanding of that material. You are free to make use of outside sources such as videos, articles and books, but if you do use them, please credit their contribution by citing them in IEEE or APA format. These citations do not count toward the total word count.]

Inflation is a measure of how much prices for goods and services are rising. Lots of factors affect prices—how difficult a product is to find, the cost of labor and the raw materials used to make it, and competition among the places selling it, to name a few. Policies that stimulate economic growth can cause inflation, too: when people have more money, their demand for products and services can rise, and that can pull up prices.[9] When the general price level rises, each unit of currency buys fewer goods and services consequently, inflation corresponds to a reduction in the purchasing power of money.[10]

When there is more money in an economy then there are products, consumers tend to buy more products, as such, more demands for prices arise, and becomes more difficult for businesses to sell products as they get sold out sooner. One way to tackle the issue is to simply increase the price of the products, so that consumers with the highest demand can buy the product. That's why, in an economy, when there's more money, average costs of individual items rise to meet the demand and supply curve: ***more demand, less supply = higher average prices***. CPI is a measurement used to understand how much on average the prices have gone up.

In general, too little or no inflation is a bad thing for the economy too, but too high rates of inflation (or hyperinflation) is a bad thing too, as it brings negative consequences for an overall economy. To tackle higher inflation rates, Central Banks of an economy generally hikes up the interest rates so that an average consumer can start saving up by putting money in the bank as they are going to get higher rates of return. This essentially incentivizes consumers to spend less and save more! This helps bring down the average cost of products in general, as demands get lower, effectively bringing inflation down to a targeted not-too-low and not-too-high rate, which can be beneficial for the economy.

From the above, BoC increased the interest rates to rebalance the demand-supply curve (***balanced demand, balanced supply = targeted inflation rate***). This way the inflation rate (CPI=Consumer Price Index Rate) will come down to 3% by the end of 2023 and 2% (targeted inflation rate) by the end of 2024.

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[8] Bank of Canada. (2022, October 26). Bank of Canada increases policy interest rate by 50 basis points, continues quantitative tightening. https://www.bankofcanada.ca/2022/10/fad-press-release-2022-10-26/

[9] "The Fed - What is inflation and how does the Federal Reserve evaluate changes in the rate of inflation?" *Board of Governors of the Federal Reserve System*, 2016. https://www.federalreserve.gov/faqs/economy_14419.htm

[10] "Price Check: Inflation in Canada," *www.bankofcanada.ca*. https://www.bankofcanada.ca/2019/02/price-check-inflation-in-canada/