Suggested Solutions to Practice Problems (Chapter 02)

2. **Coal producer, steel producer, and consumers.**

a) i) Product approach: Coal producer produces 15 million tonnes of coal at $5/tonne, which adds $75 million to GDP. The steel producer produces $10 million tonnes of steel at $20/tonne, which is worth $200 million. The steel producer pays $125 million for 25 million tonnes of coal at $5/tonne. The steel producer's value added is, therefore, $75 million. GDP is equal to $75 million + $75 million = $150 million.

ii) Expenditure approach: Consumers buy 8 million tonnes of steel at $20/tonne, so consumption is $160 million. There is no investment and no government spending. Exports are 2 million tonnes of steel at $20/tonne, which is worth $40 million. Imports are 10 million tonnes of coal at $5/tonne, which is worth $50 million. Net exports are, therefore, equal to $40 million – $50 million = –$10 million. GDP is, therefore, equal to $160 million + (–$10 million) = $150 million.

iii) Income approach: The coal producer pays $50 million in wages and the steel producer pays $40 million in wages, so total wages in the economy equal $90 million. The coal producer receives $75 million in revenue for selling 15 million tonnes at $5/tonne. The coal producer pays $50 million in wages, so the coal producer's profits are $25 million. The steel producer receives $200 million in revenue for selling 10 million tonnes of steel at $20/tonne. The steel producer pays $40 million in wages and pays $125 million for the 25 million tonnes of coal that it needs to produce steel. The steel producer's profits are, therefore, equal to $200 million – $40 million – $125 million = $35 million. Total profit income in the economy is therefore $25 million + $35 million = $60 million. GDP is therefore equal to wage income ($90 million) plus profit income ($60 million). GDP is therefore $150 million.

b) There are no net factor payments from abroad in this example. Therefore, the current account surplus is equal to net exports, which is equal to (–$10 million).

3. **Wheat and Bread**

a) Following the product approach, value added by firm A is total revenue from wheat sales (note that the inventory accumulation is treated as if the firm sold the wheat to itself), or $150 000. For firm B, value added is revenue from sales of bread minus the value of wheat purchased from firm A, or $100 000 – $60 000 = $40 000. Therefore, total GDP = $150 000 + $40 000 = $190 000.

b) For the expenditure approach, consumption expenditure on bread, C = \$100 000 + \$15 000 = \$115 000 (note that imports of bread are included), investment in inventories is I = \$15 000, and net exports are NX = \$75 000 – \$15 000 = \$60 000. Government expenditures are G = 0. Therefore,
GDP = $C + I + G + NX$ = \$115 000 + \$15 000 + 0 + \$60 000 = \$190 000.

c) For the income approach, in this case GDP is the sum of profits and wage income. Profits for firm A are \$150 000 – \$50 000 = \$100 000 (revenue minus wage costs, where inventory accumulation is included as a positive amount) and profits for firm B are \$100 000 – \$20 000 – \$60 000 = \$20 000 (revenue minus wage costs minus the cost of the intermediate input). Total wages are \$50 000 + \$20 000 = \$70 000. Therefore, GDP = profits + wages = \$100 000 + \$20 000 + \$70 000 = \$190 000.

4. Price and quantity data are given as the following:

Year 1

Good	***Quantity***	***Price***
Computers	20	\$1000
Bread	10 000	\$1.00

Year 2

Good	***Quantity***	***Price***
Computers	25	\$1500
Bread	12 000	\$1.10

a) Year 1 nominal GDP = 20 × \$1000 + 10 000 × \$1.00 = \$30 000.
Year 2 nominal GDP = 25 × \$1500 + 12 000 × \$1.10 = \$50 700.

b) With year 1 as the base year, we need to value both years' production at year 1 prices. In the base year, year 1, real GDP equals nominal GDP equals \$30 000.
In year 2, we need to value year 2's output at year 1 prices. Year 2 real GDP = 25 × \$1000 + 12 000 × \$1.00 = \$37 000. The percentage change in real GDP equals [(\$37 000 – \$30 000)/\$30 000] × 100 = 23.3%.

We next calculate chain-weighted real GDP. At year 1 prices, the ratio of year 2 real GDP to year 1 real GDP equals g_1 = (\$37 000/\$30 000) = 1.2333. We must next compute real GDP using year 2 prices. Year 2 GDP valued at year 2 prices equals year 2 nominal GDP = \$50,700. Year 1 GDP valued at year 2 prices equals (20 × \$1500) + (10 000 × \$1.10) = \$41 000. The ratio of year 2 GDP at year 2 prices to year 1 GDP at year 2 prices equals g_2 = (\$50 700/\$41 000) = 1.2367. The chain-weighted ratio of real GDP in the two years therefore is equal to $g_c = \sqrt{g_1 g_2} = 1.23496$. The percentage change chain-weighted real GDP from year 1 to year 2 is therefore approximately 23.5%.

If we (arbitrarily) designate year 1 as the base year, then year 1 chain-weighted GDP equals nominal GDP equals \$30 000.Year 2 chain-weighted real GDP is equal to (1.23496 × \$30 000) = \$37 049, approximately.

Alternatively, we could use the average price method. To perform a calculation using this method, we first compute average prices. The average price for computers equals (\$1000 + \$1500)/2 = \$1250. The average price for bread equals (\$1.00 + \$1.10)/2 = \$1.05. Year 1 output valued at average prices equals 20 × \$1250 + 10 000 × \$1.05 = \$35 500. Year 2 output valued at average prices equals 25 × \$1250 + 12 000 × \$1.05 = \$43 850. The percentage change in chain-weighted GDP is therefore equal to [(\$43 850 – \$35 500)/\$35 500] × 100 = 23.5%.

c) To calculate the implicit GDP deflator, we divide nominal GDP by real GDP, and then multiply by 100 to express GDP deflator as an index number. With year 1 as the base year, base year nominal GDP equals base year real GDP, so the base year implicit GDP deflator is 100. For year 2, the implicit GDP deflator is (\$50 700/\$37 000) × 100 = 137.0. The percentage change in the deflator is equal to 37.0%.

With chain weighting, the base year is now the midpoint between the two years. The year 1 GDP deflator equals (\$30 000/\$30 000) × 100 = 100. The chain-weighted deflator for year 2 equals (\$50 700/\$37 049) × 100 = 136.9. The percentage change in the chain-weighted deflator equals [(136.9 – 100)/100] × 100 = 36.9%.

5. Price and quantity data are given as the following:

Year 1

Good	***Quantity (million kgs.)***	***Price (per kgs.)***
Broccoli	1500	\$0.50
Cauliflower	300	\$0.80

Year 2

Good	***Quantity (million kgs.)***	***Price (per kgs.)***
Broccoli	2400	\$0.60
Cauliflower	350	\$0.85

a) Year 1 nominal GDP = Year 1 real GDP
   = 1500m. × \$0.50 + 300m. × \$0.80 = \$990m.
   Year 2 nominal GDP = 2400m × \$0.60 + 350m. × \$0.85 = \$1737.5m.
   Year 2 real GDP = 2400m. × \$0.50 + 350m. × \$0.80 = \$1480m.

   Year 1 GDP deflator equals 100.
   Year 2 GDP deflator equals (\$1737.5/\$1480) × 100 = 117.4.
   The percentage change in the deflator equals 17.4%.

b) Year 1 production (market basket) at year 1 prices equals year 1 nominal GDP = \$990m. The value of the market basket at year 2 prices is equal to \$900 + \$255 = \$1155.
   Year 1 CPI equals 100.
   Year 2 CPI equals (\$1155/\$990) × 100 = 116.7.
   The percentage change in the CPI equals 16.7%.

   The relative price of broccoli has gone up. The relative quantity of broccoli has also gone up. The CPI attaches a smaller weight to the price of broccoli, and so the CPI shows less inflation.

8. **Corn producer, consumers, and government**.

a) i) Product approach: There are no intermediate goods inputs. The corn producer grows 3 million tonnes of corn. Each tonne of corn is worth \$50. Therefore, GDP equals \$150 million.
   ii) Expenditure approach: Consumers buy 2 million tonnes of corn, so consumption equals \$100 million. The corn producer adds 0.5 million tonnes to inventory, so investment equals \$25 million. The government buys 0.5 million tonnes of corn. Consequently, government spending equals \$25 million. GDP equals \$150 million.

   iii) Income approach: Wage income is \$60 million, paid by the corn producer. The corn producer's revenue equals \$150 million, including the value of its addition to inventory. Additions to inventory are treated as purchasing one's own output. The corn producer's costs include wages of \$60 million and taxes of \$20 million. Therefore, profit income equals \$150 million – \$60 million – \$20 million = \$70 million. Government income equals taxes paid by the corn producer, which equals \$20 million. Therefore, GDP by income equals \$60 million + \$70 million + \$20 million = \$150 million.

b) Private disposable income equals GDP (\$150 million) plus net factor payments (0) plus government transfers (\$5 million in Canada Pension Plan benefits) plus interest on the government debt (\$10 million) minus total taxes (\$30 million), which equals \$135 million. Private saving equals private disposable income (\$135 million) minus consumption (\$100 million), which equals \$35 million. Government saving equals government tax income (\$30 million) minus transfer payments (\$5 million) minus interest on the government debt ($10 million) minus government spending $25 million), which equals – $10 million. National saving equals private saving ($35 million) plus government saving – $10 million), which equals $35 million. The government budget balance equals government borrowing($10 million). Since the budget surplus is deficit, the government budget is in deficit. The government deficit is, therefore, equal to $10 million.

11.

a) By definition:

$$S^p = Y^d - C = Y + NFP + TR + INT - T - C$$

Next, recall that $Y = C + I + G + NX$. Substitute into the equation above and subtract I to obtain:

$$\begin{aligned} S^p - I &= C + I + G + NX + NFP + INT + TR - T - C - I \\ &= (NX + NFP) + (G + INT + TR - T) \\ &= CA + D \end{aligned}$$

b) Private saving, which is not used to finance domestic investment, is either lent to the domestic government to finance its deficit (D) or is lent to foreigners (CA).

12. Assume the following:

$$D = 10, INT = 5, T = 40, G = 30, C = 80, NFP = 10, CA = -5, S = 20.$$

a)
$$\begin{aligned} Y^d &= S^p + C \\ &= S + D + C \\ &= 20 + 10 + 80 = 110 \end{aligned}$$

b)
$$D = G + TR + INT - T$$
$$TR = D - G - INT + T = 10 - 30 - 5 + 40 = 15$$

c)
$$S = GNP - C - G$$
$$GNP = S + C + G = 20 + 80 + 30 = 130$$

d) $GDP = GNP - NFP = 130 - 10 = 120$

e) $Government\ Surplus = S^g = -D = -10$

f)
$$CA = NX + NFP$$
$$NX = CA - NFP = -5 - 10 = -15$$

g)
$$GDP = C + I + G + NX$$
$$I = GDP - C - G - NX = 120 - 80 - 30 + 15 = 25$$

13. If the unemployment rate is 5% and the number of unemployed is 2.5 million, therefore the labour force must be 2 500 000/.05 = 50 million. The participation rate is then (50/100) × 100% = 50%. The number of employed = 0.95 × 50 = 47.5 million, and the employment/population ratio = (47.5/100) × 100% = 47.5%.