

## 6.1.0 → Overview

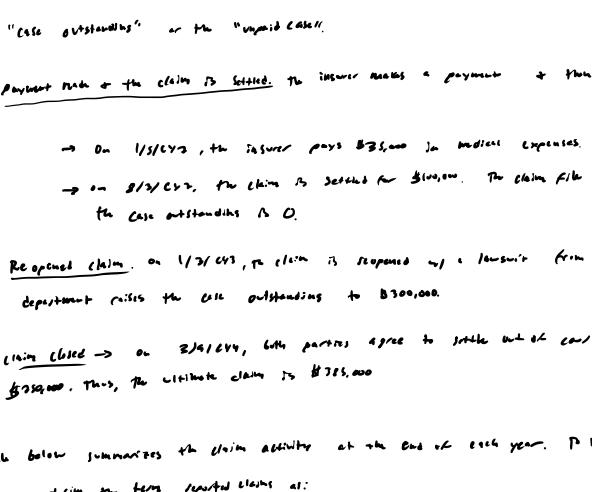
→ overviewing one of the most important functions that property/casualty (P/C) actuaries perform is loss reserving. In this section, we will discuss a number of techniques used to estimate unpaid claims, an essential part of loss reserves.

→ To get some groundwork before exploring the techniques, we will cover the following topics:

- Understanding claims data
- Importance of accurately estimating unpaid claims
- Actuarial standard of practice: IBNR

### 6.1.1 → Understanding claims data

→ overview → Actuaries typically estimate unpaid claims on an aggregate level rather than on an individual claim level. However, to better illustrate the aggregate approach, consider the following example of an individual bodily injury claim resulting from a car accident:



→ Here are the key details:

- Inurred but not reported: The accident occurred on 1/12/CY2, but a claim was not submitted to the insurance agent until 5/1/CY2.
- Reported but not recorded: From 5/1/CY2 to 6/1/2022, the claim is in transit & is submitted to & recorded by the insurer. Upon receiving the claim, a claims file is created & the claim is officially reported.
- Case outstanding on a Known Claim: At the end of the known calendar year, after investigating the claim, the claims department estimates it will cost \$300,000 to settle the claim. The claims department's estimate is referred to as the "case outstanding" on the "Known Claim".
- Payment path of the claim is stated: The insurer makes a payment & then settles the claim.
  - On 1/5/CY2, the insurer pays \$35,000 in medical expenses.
  - On 8/3/CY2, the claim is settled for \$100,000. The claims file is considered closed & thus at the end of the year the case outstanding is \$0.
- Reopened claim: On 1/3/CY3, the claim is reopened w/ a lawsuit from the injured. By the end of the year, the claims department raises the case outstanding to \$300,000.
- Claim closed: On 3/9/CY3, both parties agree to settle out-of-court & the claim is closed after a final payment of \$250,000. Thus, the ultimate claim is \$300,000.

→ The table below summarizes the claim activity at the end of each year. To keep track of cumulative paid claims & the case outstanding, we define the term Reported Claims as:

$$\text{Reported Claims} = \text{Paid Claims} + \text{Case Outstanding}$$

Date	Reported Claims	Paid Claims	Case Outstanding
12/31/CY1	200,000	0	200,000
12/31/CY2	135,000	135,000	0
12/31/CY3	435,000	135,000	300,000
12/31/CY4	385,000	385,000	0

→ We can generalize the above example to a block of business. In other words, a simple approach to estimate unpaid claims for a block of business is to sum up the case outstanding for all claims, then add the following items to account for uncertainty:

- An amount for claims incurred but not reported (IBNR)
- A provision for claims reported but not recorded
- A provision for future development of known claims, i.e. adjustments or case reserves. This is also referred to as known but not enough reported (IBKBR).
- An estimate for reopened claims

→ The sum of these listed items is referred to as the broad definition of incurred but not reported (IBNR). That:

$$\text{Unpaid Claims} = \text{Case Outstanding} + \text{IBNR}$$

↳ Broad definition

→ Key relationships & data

→ In the next section, we will look at a variety of methods that can be used to estimate unpaid claims. In general, these methods estimate unpaid claims still in development by projecting ultimate claims to their outstanding claims paid-to-date.

$$\boxed{\text{Unpaid Claims} = \text{Ultimate Claims} - \text{Paid Claims}}$$

Equating the two previous equations & rearranging creates an important relationship:

$$\boxed{\text{Ultimate Claims} - \text{Paid Claims} = \text{Case Outstanding} + \text{IBNR}}$$

$$\boxed{\begin{aligned} \text{Ultimate Claims} &= \text{Paid Claims} + \text{Case Outstanding} + \text{IBNR} \\ &\downarrow \\ &= \text{Reported Claims} + \text{IBNR} \end{aligned}}$$

→ In addition to the estimate itself, when providing an unpaid claims estimate three key dates are required:

- Accounting date → This date separates paid vs unpaid claim amounts
- Valuation date → The date through which transactions are included in the estimate. This date can be before, on, or after the accounting date

→ Review date → The cutoff date for information known to the actuary

→ For example, consider an actuary who estimates unpaid claims as of 12/31/2022 (the accounting date) for data evaluated through 1/15/2023 (the valuation date), w/ additional information provided through 1/20/2023 (the review date).

→ Most problems will not specifically list the accounting date, valuation date, or review date. In a majority of cases relevant to the exam, all three dates will be the same.

→ For example, you could be asked to assess 2020 unpaid claims as of 12/31/2022 (the accounting date) for data evaluated through 1/15/2023 (the valuation date), w/ additional information provided through 1/20/2023 (the review date).

→ With that being said, to better illustrate the impact of the dates, let's look at an example.

→ Example → You are given the following policy information from a line of business in Company A as of 12/31/CY2022.

Claim Number	Policy Effective Date	Accident Date	Transaction Date	Incremental Paid Claims	Case Outstanding
1	1/1/2020	8/13/2020	8/13/2020	\$50	\$50
			12/15/2020	\$130	\$220
			3/1/2021	\$320	0
2	5/1/2020	6/11/2020	6/11/2020	\$170	\$230
			12/10/2020	\$110	\$140
			4/15/2021	\$0	\$300
3	11/1/2020	3/15/2021	8/4/2021	\$510	\$0
			3/15/2021	\$200	\$330
			9/2/2023	\$100	\$100
			12/21/2023	\$110	0

Assume that these are the only claims reported to Company A and that the reserve prior to 1/1/2020 is 0.

An actuary at Company A makes unpaid claims estimates for accident years 2020 and 2021 using varying accounting and valuation dates. They use these to generate the ultimate claims estimates in the table below.

Estimate	Accident Year	Accounting Date	Valuation Date	Estimated Ultimate Claims
1	AY2020	12/31/2020	11/30/2020	\$1,300
2	AY2020	12/31/2020	11/30/2021	\$1,550
3	AY2021	12/31/2021	12/31/2021	\$700

The actuary's analysis is based on the provisions below.

- Provision for development on known claims: 50% of AY case outstanding.
- Provision for reopened claims: 5% of total claims closed for that AY.
- Provision for claims reported but not recorded: 20% of pure IBNR.
- Assume claims are closed when the case reserve reaches 0.

Assuming the actuary's projections are accurate, calculate:

- (a) AY2020 pure IBNR implied by Estimate 1.

- (b) AY2020 pure IBNR implied by Estimate 2.

- (c) the total pure IBNR for Company A as of 12/31/2021.

→ In AY2020, the valuation date for Estimate 3 is 1/15/2023, so we only information up through 1/15/2023 for part (c). We can focus on claims 1 + 2 since claim 3 does not occur during AY2020.

$$\text{AY2020 Unpaid Claims} = \text{AY2020 Ultimate Claims} - \text{AY2020 Paid Claims}$$

$$\text{AY2020 Ultimate Claims} = \text{AY2020 Paid Claims} + \text{Case Outstanding} + \text{IBNR}$$

$$\text{AY2020 Paid Claims} = \text{AY2020 Case Outstanding} + \text{IBNR}$$

$$\text{AY2020 Case Outstanding} = \text{AY2020 Paid Claims} + \text{IBNR}$$

$$\text{AY2020 IBNR} = \text{AY2020 Paid Claims} + \text{IBNR}$$

$$\text{AY2020 IBNR} = \text{AY2020 Paid Claims} + 0.2(\text{AY2020 Case Outstanding}) + 0.5(\text{AY2020 Case Outstanding}) + 0.05(\text{AY2020 Case Outstanding})$$

$$\text{AY2020 IBNR} = \text{AY2020 Paid Claims} + 0.2(50) + 0.5(220) + 0.05(220)$$

$$\text{AY2020 IBNR} = 50 + 110 + 11 = 171$$

$$\text{AY2020 Unpaid Claims} = \text{AY2020 Paid Claims} + \text{IBNR}$$

$$\text{AY2020 Unpaid Claims} = 50 + 171 = 221$$

$$\text{AY2020 Unpaid Claims} = 221 - 171 = 50$$

$$\text{AY2020 Unpaid Claims} = 50 + 0.5(50) = 75$$

$$\text{AY2020 Unpaid Claims} = 75 + 0.05(75) = 81.25$$

$$\text{AY2020 Unpaid Claims} = 81.25 + 0.2(81.25) = 100.5$$

$$\text{AY2020 Unpaid Claims} = 100.5 + 0.5(100.5) + 0.05(100.5) = 150.75$$

$$\text{AY2020 Unpaid Claims} = 150.75 + 0.2(150.75) = 186.93$$

$$\text{AY2020 Unpaid Claims} = 186.93 + 0.5(186.93) + 0.05(186.93) = 286.88$$

→ For Estimate 2, the valuation date is 1/15/2023, so we information up through 1/15/2023 for part (b). Be careful though, the accounting date is still 12/31/2020.

→ Notice that the accounting date is different from the one used to estimate the AY2020 pure IBNR in part (b). It would be a mistake to assume that the answer to part (b) would apply here since claims have been paid since then. However, the estimated ultimate claims would still be valid. So, we must recalculate the pure IBNR for each AY of 12/31/2020 based on the most recent ultimate estimates (Estimates 2 + 3).

→ Starting w/ AY2020:

$$\text{AY2020 Unpaid Claims} = \text{AY2020 Ultimate Claims} - \text{AY2020 Paid Claims}$$

$$\text{AY2020 Ultimate Claims} = \text{AY2020 Paid Claims} + \text{Case Outstanding} + \text{IBNR}$$

$$\text{AY2020 Paid Claims} = \text{AY2020 Case Outstanding} + \text{IBNR}$$

$$\text{AY2020 Case Outstanding} = \text{AY2020 Paid Claims} + \text{IBNR}$$

$$\text{AY2020 IBNR} = \text{AY2020 Paid Claims} + 0.2(\text{AY2020 Case Outstanding}) + 0.5(\text{AY2020 Case Outstanding}) + 0.05(\text{AY2020 Case Outstanding})$$

$$\text{AY2020 IBNR} = \text{AY2020 Paid Claims} + 0.2(50) + 0.5(220) + 0.05(220) = 171.25$$

$$\text{AY2020 Unpaid Claims} = \text{AY2020 Paid Claims} + \text{IBNR}$$

$$\text{AY2020 Unpaid Claims} = 50 + 171.25 = 221.25$$

$$\text{AY2020 Unpaid Claims} = 221.25 + 0.5(221.25) = 331.88$$

$$\text{AY2020 Unpaid Claims} = 331.88 + 0.2(331.88) = 401.26$$

$$\text{AY2020 Unpaid Claims} = 401.26 + 0.5(401.26) + 0.05(401.26) = 601.91$$