

## Appendix I. Google Cloud Natural Language

We analyzed 15 sentences in five different forms; a total of 75 sentences. We note that the score is from -1 to 1, and -1 to -0.25 is considered negative, -0.25 to 0.25 is considered neutral, and 0.25 to 1 is considered positive sentiment.

### A. Downward entailment

#### A1. A = “Bill”, never, B = negative adjectives (0/15 correct)

- 0: 'Bill has never done anything cynical.': -0.7 Negative
- 1: 'Bill has never done anything grumpy.': -0.5 Negative
- 2: 'Bill has never done anything indecisive.': -0.4 Negative
- 3: 'Bill has never done anything thoughtless.': -0.8 Negative
- 4: 'Bill has never done anything arrogant.': -0.9 Negative
- 5: 'Bill has never done anything cruel.': -0.7 Negative
- 6: 'Bill has never done anything foolish.': -0.8 Negative
- 7: 'Bill has never done anything impolite.': -0.9 Negative
- 8: 'Bill has never done anything mean.': -0.3 Negative
- 9: 'Bill has never done anything rude.': -0.9 Negative
- 10: 'Bill has never done anything selfish.': -0.7 Negative
- 11: 'Bill has never done anything stupid.': -0.9 Negative
- 12: 'Bill has never done anything vulgar.': -0.6 Negative
- 13: 'Bill has never done anything terrible.': -0.9 Negative
- 14: 'Bill has never done anything awful.': -0.8 Negative

#### A2. A = subject phrases, never, B = negative adjectives (0/15 correct)

- 0: 'Bill has never done anything cynical.': -0.7 Negative
- 1: 'Sally has never done anything grumpy.': -0.6 Negative
- 2: 'I have never done anything indecisive.': -0.4 Negative
- 3: 'Sarah has never done anything thoughtless.': -0.8 Negative
- 4: 'We have never done anything arrogant.': -0.9 Negative
- 5: 'Bill and Sarah have never done anything cruel.': -0.8 Negative
- 6: 'Justin has never done anything foolish.': -0.8 Negative
- 7: 'Isaac has never done anything impolite.': -0.8 Negative
- 8: 'Sarah and her mom have never done anything mean.': -0.2 Neutral
- 9: 'John's family has never done anything rude.': -0.7 Negative
- 10: 'Bill and his friends have never done anything selfish.': -0.7 Negative
- 11: 'Bill's friend has never done anything stupid.': -0.9 Negative
- 12: 'Sally from France has never done anything vulgar.': -0.6 Negative
- 13: 'Bill in my English class has never done anything terrible.': -0.9 Negative
- 14: 'John, Sarah, and Bill have never done anything awful.': -0.6 Negative

#### A3. A = “Bill”, not, B = negative adjectives (0/15 correct)

- 0: 'Bill has not done anything cynical.': -0.7 Negative
- 1: 'Bill has not done anything grumpy.': -0.6 Negative
- 2: 'Bill has not done anything indecisive.': -0.5 Negative
- 3: 'Bill has not done anything thoughtless.': -0.8 Negative
- 4: 'Bill has not done anything arrogant.': -0.9 Negative
- 5: 'Bill has not done anything cruel.': -0.7 Negative
- 6: 'Bill has not done anything foolish.': -0.8 Negative
- 7: 'Bill has not done anything impolite.': -0.9 Negative

- 8: 'Bill has not done anything mean.': -0.4 Negative
- 9: 'Bill has not done anything rude.': -0.9 Negative
- 10: 'Bill has not done anything selfish.': -0.7 Negative
- 11: 'Bill has not done anything stupid.': -0.9 Negative
- 12: 'Bill has not done anything vulgar.': -0.5 Negative
- 13: 'Bill has not done anything terrible.': -0.9 Negative
- 14: 'Bill has not done anything awful.': -0.8 Negative

**Base sentence: [A] has/have done something [B].**

**A4. A = “Bill”, B = negative adjectives (12/15 correct)**

- 0: 'Bill has done something cynical.': -0.5 Negative
- 1: 'Bill has done something grumpy.': -0.5 Negative
- 2: 'Bill has done something indecisive.': 0.2 Neutral
- 3: 'Bill has done something thoughtless.': -0.2 Neutral
- 4: 'Bill has done something arrogant.': -0.9 Negative
- 5: 'Bill has done something cruel.': -0.6 Negative
- 6: 'Bill has done something foolish.': -0.7 Negative
- 7: 'Bill has done something impolite.': -0.9 Negative
- 8: 'Bill has done something mean.': 0 Neutral
- 9: 'Bill has done something rude.': -0.9 Negative
- 10: 'Bill has done something selfish.': -0.7 Negative
- 11: 'Bill has done something stupid.': -0.8 Negative
- 12: 'Bill has done something vulgar.': -0.8 Negative
- 13: 'Bill has done something terrible.': -0.9 Negative
- 14: 'Bill has done something awful.': -0.9 Negative

**A5. A = subject phrases, B = negative adjectives (12/15 correct)**

- 0: 'Bill has done something cynical.': -0.5 Negative
- 1: 'Sally has done something grumpy.': -0.5 Negative
- 2: 'I have done something indecisive.': 0.3 Positive
- 3: 'Sarah has done something thoughtless.': -0.2 Neutral
- 4: 'We have done something arrogant.': -0.9 Negative
- 5: 'Bill and Sarah have done something cruel.': -0.6 Negative
- 6: 'Justin has done something foolish.': -0.7 Negative
- 7: 'Isaac has done something impolite.': -0.7 Negative
- 8: 'Sarah and her mom have done something mean.': 0.1 Neutral
- 9: 'John's family has done something rude.': -0.7 Negative
- 10: 'Bill and his friends have done something selfish.': -0.6 Negative
- 11: 'Bill's friend has done something stupid.': -0.8 Negative
- 12: 'Sally from France has done something vulgar.': -0.8 Negative
- 13: 'Bill in my English class has done something terrible.': -0.9 Negative
- 14: 'John, Sarah, and Bill have done something awful.': -0.6 Negative

## **B. Non-monotone quantifiers**

**Base sentence: [A: non-monotone] had [never or not] done anything [B].**

**B1. A = “Exactly half”, never, B = negative adjectives (0/15 correct)**

- 0: 'Exactly half had never done anything cynical.': -0.8 Negative
- 1: 'Exactly half had never done anything grumpy.': -0.6 Negative
- 2: 'Exactly half had never done anything indecisive.': -0.8 Negative
- 3: 'Exactly half had never done anything thoughtless.': -0.9 Negative
- 4: 'Exactly half had never done anything arrogant.': -0.9 Negative
- 5: 'Exactly half had never done anything cruel.': -0.8 Negative
- 6: 'Exactly half had never done anything foolish.': -0.9 Negative
- 7: 'Exactly half had never done anything impolite.': -0.9 Negative
- 8: 'Exactly half had never done anything mean.': -0.8 Negative
- 9: 'Exactly half had never done anything rude.': -0.9 Negative
- 10: 'Exactly half had never done anything selfish.': -0.8 Negative
- 11: 'Exactly half had never done anything stupid.': -0.9 Negative
- 12: 'Exactly half had never done anything vulgar.': -0.6 Negative
- 13: 'Exactly half had never done anything terrible.': -0.9 Negative
- 14: 'Exactly half had never done anything awful.': -0.9 Negative

**B2. A = subject phrases, never, B = negative adjectives (0/15 correct)**

- 0: 'Exactly half had never done anything cynical.': -0.8 Negative
- 1: 'Exactly ten students had never done anything grumpy.': -0.7 Negative
- 2: '60 % of students had never done anything indecisive.': -0.8 Negative
- 3: 'Ninety percent of kids had never done anything thoughtless.': -0.8 Negative
- 4: 'Ninety percent of parents had never done anything arrogant.': -0.9 Negative
- 5: 'Exactly half of actors had never done anything cruel.': -0.9 Negative
- 6: '20 % of dancers had never done anything foolish.': -0.9 Negative
- 7: 'Exactly three-quarters had never done anything impolite.': -0.9 Negative
- 8: 'Half of Sarah's friends had never done anything mean.': -0.4 Negative
- 9: 'Ten criminals had never done anything rude.': -0.9 Negative
- 10: '99 % of people had never done anything selfish.': -0.8 Negative
- 11: 'Fifteen percent of couples had never done anything stupid.': -0.9 Negative
- 12: 'Exactly twelve singers had never done anything vulgar.': -0.4 Negative
- 13: 'Exactly three-quarters of programmers had never done anything terrible.': -0.9 Negative
- 14: 'Exactly two friends had never done anything awful.': -0.8 Negative

**B3. A = "Exactly half", not, B = negative adjectives (0/15 correct)**

- 0: 'Exactly half had not done anything cynical.': -0.7 Negative
- 1: 'Exactly half had not done anything grumpy.': -0.6 Negative
- 2: 'Exactly half had not done anything indecisive.': -0.8 Negative
- 3: 'Exactly half had not done anything thoughtless.': -0.9 Negative
- 4: 'Exactly half had not done anything arrogant.': -0.8 Negative
- 5: 'Exactly half had not done anything cruel.': -0.8 Negative
- 6: 'Exactly half had not done anything foolish.': -0.8 Negative
- 7: 'Exactly half had not done anything impolite.': -0.9 Negative
- 8: 'Exactly half had not done anything mean.': -0.7 Negative
- 9: 'Exactly half had not done anything rude.': -0.9 Negative
- 10: 'Exactly half had not done anything selfish.': -0.7 Negative
- 11: 'Exactly half had not done anything stupid.': -0.9 Negative
- 12: 'Exactly half had not done anything vulgar.': -0.6 Negative
- 13: 'Exactly half had not done anything terrible.': -0.9 Negative
- 14: 'Exactly half had not done anything awful.': -0.9 Negative

**Base sentence: [A: non-monotone] had done something [B].**

**B4. A = "Exactly half", B = negative adjectives (14/15 correct)**

- 0: 'Exactly half had done something cynical.': -0.7 Negative
- 1: 'Exactly half had done something grumpy.': -0.6 Negative
- 2: 'Exactly half had done something indecisive.': 0.1 Neutral
- 3: 'Exactly half had done something thoughtless.': -0.6 Negative
- 4: 'Exactly half had done something arrogant.': -0.9 Negative
- 5: 'Exactly half had done something cruel.': -0.8 Negative
- 6: 'Exactly half had done something foolish.': -0.8 Negative
- 7: 'Exactly half had done something impolite.': -0.9 Negative
- 8: 'Exactly half had done something mean.': -0.3 Negative
- 9: 'Exactly half had done something rude.': -0.9 Negative
- 10: 'Exactly half had done something selfish.': -0.7 Negative
- 11: 'Exactly half had done something stupid.': -0.8 Negative
- 12: 'Exactly half had done something vulgar.': -0.8 Negative
- 13: 'Exactly half had done something terrible.': -0.9 Negative
- 14: 'Exactly half had done something awful.': -0.9 Negative

**B5. A = subject phrases, B = negative adjectives (13/15 correct)**

- 0: 'Exactly half had done something cynical.': -0.7 Negative
- 1: 'Exactly ten students had done something grumpy.': 0.1 Neutral
- 2: '60 % of students had done something indecisive.': -0.3 Negative
- 3: 'Ninety percent of kids had done something thoughtless.': -0.9 Negative
- 4: 'Ninety percent of parents had done something arrogant.': -0.7 Negative
- 5: 'Exactly half of actors had done something cruel.': -0.7 Negative
- 6: '20 % of dancers had done something foolish.': -0.8 Negative
- 7: 'Exactly three-quarters had done something impolite.': -0.8 Negative
- 8: 'Half of Sarah's friends had done something mean.': -0.1 Neutral
- 9: 'Ten criminals had done something rude.': -0.9 Negative
- 10: '99 % of people had done something selfish.': -0.7 Negative
- 11: 'Fifteen percent of couples had done something stupid.': -0.8 Negative
- 12: 'Exactly twelve singers had done something vulgar.': -0.7 Negative
- 13: 'Exactly three-quarters of programmers had done something terrible.': -0.9 Negative
- 14: 'Exactly two friends had done something awful.': -0.8 Negative

## Appendix II. Analysis using Stanford CoreNLP

We passed the previous 75 sentences through Stanford's CoreNLP client to observe misclassifications. For each sentence, the sentiment analyzer returns a class: 0-Very Negative, 1-Negative, 2-Neutral, 3-Positive, 4-Very Positive.

### A. Downward entailment

**Base sentence:** [A] has/have [never or not] done anything [B].

**A1. A = "Bill", never, B = negative adjectives (0/15 correct)**

- 0: 'Bill has never done anything cynical.': 2 Neutral
- 1: 'Bill has never done anything grumpy.': 2 Neutral
- 2: 'Bill has never done anything indecisive.': 2 Neutral
- 3: 'Bill has never done anything thoughtless.': 2 Neutral
- 4: 'Bill has never done anything arrogant.': 1 Negative

- 5: 'Bill has never done anything cruel.': 2 Neutral
- 6: 'Bill has never done anything foolish.': 2 Neutral
- 7: 'Bill has never done anything impolite.': 2 Neutral
- 8: 'Bill has never done anything mean.': 2 Neutral
- 9: 'Bill has never done anything rude.': 1 Negative
- 10: 'Bill has never done anything selfish.': 2 Neutral
- 11: 'Bill has never done anything stupid.': 1 Negative
- 12: 'Bill has never done anything vulgar.': 1 Negative
- 13: 'Bill has never done anything terrible.': 1 Negative
- 14: 'Bill has never done anything awful.': 1 Negative

**A2. A = subject phrases, never, B = negative adjectives (0/15 correct)**

- 0: 'Bill has never done anything cynical.': 2 Neutral
- 1: 'Sally has never done anything grumpy.': 1 Negative
- 2: 'I have never done anything indecisive.': 1 Negative
- 3: 'Sarah has never done anything thoughtless.': 1 Negative
- 4: 'We have never done anything arrogant.': 1 Negative
- 5: 'Bill and Sarah have never done anything cruel.': 1 Negative
- 6: 'Justin has never done anything foolish.': 1 Negative
- 7: 'Isaac has never done anything impolite.': 1 Negative
- 8: 'Sarah and her mom have never done anything mean.': 1 Negative
- 9: 'John's family has never done anything rude.': 1 Negative
- 10: 'Bill and his friends have never done anything selfish.': 1 Negative
- 11: 'Bill's friend has never done anything stupid.': 1 Negative
- 12: 'Sally from France has never done anything vulgar.': 1 Negative
- 13: 'Bill in my English class has never done anything terrible.': 1 Negative
- 14: 'John, Sarah, and Bill have never done anything awful.': 1 Negative

**A3. A = "Bill", not, B = negative adjectives (0/15 correct)**

- 0: 'Bill has not done anything cynical.': 1 Negative
- 1: 'Bill has not done anything grumpy.': 1 Negative
- 2: 'Bill has not done anything indecisive.': 1 Negative
- 3: 'Bill has not done anything thoughtless.': 1 Negative
- 4: 'Bill has not done anything arrogant.': 1 Negative
- 5: 'Bill has not done anything cruel.': 1 Negative
- 6: 'Bill has not done anything foolish.': 1 Negative
- 7: 'Bill has not done anything impolite.': 1 Negative
- 8: 'Bill has not done anything mean.': 1 Negative
- 9: 'Bill has not done anything rude.': 1 Negative
- 10: 'Bill has not done anything selfish.': 1 Negative
- 11: 'Bill has not done anything stupid.': 1 Negative
- 12: 'Bill has not done anything vulgar.': 1 Negative
- 13: 'Bill has not done anything terrible.': 1 Negative
- 14: 'Bill has not done anything awful.': 1 Negative

**Base sentence: [A] has/have done something [B].**

**A4. A = "Bill", B = negative adjectives (5/15 correct)**

- 0: 'Bill has done something cynical.': 2 Neutral
- 1: 'Bill has done something grumpy.': 2 Neutral
- 2: 'Bill has done something indecisive.': 2 Neutral
- 3: 'Bill has done something thoughtless.': 2 Neutral
- 4: 'Bill has done something arrogant.': 2 Neutral

- 5: 'Bill has done something cruel.': 2 Neutral
- 6: 'Bill has done something foolish.': 2 Neutral
- 7: 'Bill has done something impolite.': 2 Neutral
- 8: 'Bill has done something mean.': 2 Neutral
- 9: 'Bill has done something rude.': 1 Negative
- 10: 'Bill has done something selfish.': 2 Neutral
- 11: 'Bill has done something stupid.': 1 Negative
- 12: 'Bill has done something vulgar.': 1 Negative
- 13: 'Bill has done something terrible.': 1 Negative
- 14: 'Bill has done something awful.': 1 Negative

#### **A5. A = subject phrases, B = negative adjectives (8/15 correct)**

- 0: 'Bill has done something cynical.': 2 Neutral
- 1: 'Sally has done something grumpy.': 3 Positive
- 2: 'I have done something indecisive.': 3 Positive
- 3: 'Sarah has done something thoughtless.': 2 Neutral
- 4: 'We have done something arrogant.': 1 Negative
- 5: 'Bill and Sarah have done something cruel.': 1 Negative
- 6: 'Justin has done something foolish.': 1 Negative
- 7: 'Isaac has done something impolite.': 3 Positive
- 8: 'Sarah and her mom have done something mean.': 2 Neutral
- 9: 'John's family has done something rude.': 1 Negative
- 10: 'Bill and his friends have done something selfish.': 3 Positive
- 11: 'Bill's friend has done something stupid.': 1 Negative
- 12: 'Sally from France has done something vulgar.': 1 Negative
- 13: 'Bill in my English class has done something terrible.': 1 Negative
- 14: 'John, Sarah, and Bill have done something awful.': 1 Negative

### **B. Non-monotone quantifiers**

**Base sentence: [A: non-monotone] had [never or not] done anything [B].**

#### **B1. A = "Exactly half", never, B = negative adjectives (0/15 correct)**

- 0: 'Exactly half had never done anything cynical.': 2 Neutral
- 1: 'Exactly half had never done anything grumpy.': 2 Neutral
- 2: 'Exactly half had never done anything indecisive.': 2 Neutral
- 3: 'Exactly half had never done anything thoughtless.': 2 Neutral
- 4: 'Exactly half had never done anything arrogant.': 1 Negative
- 5: 'Exactly half had never done anything cruel.': 1 Negative
- 6: 'Exactly half had never done anything foolish.': 1 Negative
- 7: 'Exactly half had never done anything impolite.': 2 Neutral
- 8: 'Exactly half had never done anything mean.': 2 Neutral
- 9: 'Exactly half had never done anything rude.': 1 Negative
- 10: 'Exactly half had never done anything selfish.': 2 Neutral
- 11: 'Exactly half had never done anything stupid.': 1 Negative
- 12: 'Exactly half had never done anything vulgar.': 1 Negative
- 13: 'Exactly half had never done anything terrible.': 1 Negative
- 14: 'Exactly half had never done anything awful.': 1 Negative

#### **B2. A = subject phrases, never, B = negative adjectives (0/15 correct)**

- 0: 'Exactly half had never done anything cynical.': 2 Neutral

- 1: 'Exactly ten students had never done anything grumpy.': 1 Negative
- 2: '60 % of students had never done anything indecisive.': 1 Negative
- 3: 'Ninety percent of kids had never done anything thoughtless.': 1 Negative
- 4: 'Ninety percent of parents had never done anything arrogant.': 1 Negative
- 5: 'Exactly half of actors had never done anything cruel.': 1 Negative
- 6: '20 % of dancers had never done anything foolish.': 1 Negative
- 7: 'Exactly three-quarters had never done anything impolite.': 1 Negative
- 8: 'Half of Sarah's friends had never done anything mean.': 1 Negative
- 9: 'Ten criminals had never done anything rude.': 1 Negative
- 10: '99 % of people had never done anything selfish.': 1 Negative
- 11: 'Fifteen percent of couples had never done anything stupid.': 1 Negative
- 12: 'Exactly twelve singers had never done anything vulgar.': 1 Negative
- 13: 'Exactly three-quarters of programmers had never done anything terrible.': 1 Negative
- 14: 'Exactly two friends had never done anything awful.': 1 Negative

**B3. A = “Exactly half”, not, B = negative adjectives (0/15 correct)**

- 0: 'Exactly half had not done anything cynical.': 2 Neutral
- 1: 'Exactly half had not done anything grumpy.': 1 Negative
- 2: 'Exactly half had not done anything indecisive.': 1 Negative
- 3: 'Exactly half had not done anything thoughtless.': 1 Negative
- 4: 'Exactly half had not done anything arrogant.': 1 Negative
- 5: 'Exactly half had not done anything cruel.': 1 Negative
- 6: 'Exactly half had not done anything foolish.': 1 Negative
- 7: 'Exactly half had not done anything impolite.': 1 Negative
- 8: 'Exactly half had not done anything mean.': 2 Neutral
- 9: 'Exactly half had not done anything rude.': 1 Negative
- 10: 'Exactly half had not done anything selfish.': 1 Negative
- 11: 'Exactly half had not done anything stupid.': 1 Negative
- 12: 'Exactly half had not done anything vulgar.': 1 Negative
- 13: 'Exactly half had not done anything terrible.': 1 Negative
- 14: 'Exactly half had not done anything awful.': 1 Negative

**Base sentence: [A: non-monotone] had done something [B].**

**B4. A = “Exactly half”, B = negative adjectives (5/15 correct)**

- 0: 'Exactly half had done something cynical.': 2 Neutral
- 1: 'Exactly half had done something grumpy.': 2 Neutral
- 2: 'Exactly half had done something indecisive.': 2 Neutral
- 3: 'Exactly half had done something thoughtless.': 2 Neutral
- 4: 'Exactly half had done something arrogant.': 2 Neutral
- 5: 'Exactly half had done something cruel.': 2 Neutral
- 6: 'Exactly half had done something foolish.': 2 Neutral
- 7: 'Exactly half had done something impolite.': 2 Neutral
- 8: 'Exactly half had done something mean.': 2 Neutral
- 9: 'Exactly half had done something rude.': 1 Negative
- 10: 'Exactly half had done something selfish.': 2 Neutral
- 11: 'Exactly half had done something stupid.': 1 Negative
- 12: 'Exactly half had done something vulgar.': 1 Negative
- 13: 'Exactly half had done something terrible.': 1 Negative
- 14: 'Exactly half had done something awful.': 1 Negative

**B5. A = subject phrases, B = negative adjectives (10/15 correct)**

- 0: 'Exactly half had done something cynical.': 2 Neutral

- 1: 'Exactly ten students had done something grumpy.': 2 Neutral
- 2: '60 % of students had done something indecisive.': 2 Neutral
- 3: 'Ninety percent of kids had done something thoughtless.': 1 Negative
- 4: 'Ninety percent of parents had done something arrogant.': 1 Negative
- 5: 'Exactly half of actors had done something cruel.': 2 Neutral
- 6: '20 % of dancers had done something foolish.': 1 Negative
- 7: 'Exactly three-quarters had done something impolite.': 2 Neutral
- 8: 'Half of Sarah's friends had done something mean.': 1 Negative
- 9: 'Ten criminals had done something rude.': 1 Negative
- 10: '99 % of people had done something selfish.': 1 Negative
- 11: 'Fifteen percent of couples had done something stupid.': 1 Negative
- 12: 'Exactly twelve singers had done something vulgar.': 1 Negative
- 13: 'Exactly three-quarters of programmers had done something terrible.': 1 Negative
- 14: 'Exactly two friends had done something awful.': 1 Negative