

Gabriel C-Parent Homework 3

Exercise 1

Data

```
REPORT on Tally stat. collector ==> HIT-OR-MISS {a= 0.0, b= 2.0, k= 1.0}
  num. obs.      min      max      average      standard dev.
  10000          0.000      2.766      0.017      0.166
  95.0% confidence interval for mean (student): (    0.014,    0.021 )
```

```
REPORT on Tally stat. collector ==> IS {a= 0.0, b= 2.0, k= 1.0}
  num. obs.      min      max      average      standard dev.
  10000          1.4E-6      0.082      0.019      0.013
  95.0% confidence interval for mean (student): (    0.018,    0.019 )
```

```
REPORT on Tally stat. collector ==> HIT-OR-MISS {a= 0.0, b= 3.0, k= 1.0}
  num. obs.      min      max      average      standard dev.
  10000          0.000      3.287      3.2E-3      0.091
  95.0% confidence interval for mean (student): (    1.5E-3,    5.0E-3 )
```

```
REPORT on Tally stat. collector ==> IS {a= 0.0, b= 3.0, k= 1.0}
  num. obs.      min      max      average      standard dev.
  10000          7.9E-8      0.014      3.4E-3      2.6E-3
  95.0% confidence interval for mean (student): (    3.3E-3,    3.4E-3 )
```

```
REPORT on Tally stat. collector ==> HIT-OR-MISS {a= 0.0, b= 4.0, k= 1.0}
  num. obs.      min      max      average      standard dev.
  10000          0.000      0.000      0.000      0.000
  95.0% confidence interval for mean (student): (    0.000,    0.000 )
```

```
REPORT on Tally stat. collector ==> IS {a= 0.0, b= 4.0, k= 1.0}
  num. obs.      min      max      average      standard dev.
  10000          9.6E-11      9.8E-4      2.3E-4      2.1E-4
  95.0% confidence interval for mean (student): (    2.2E-4,    2.3E-4 )
```

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Discussion

ratios between the variances (for same b and n)

- let's see the ratios between the standard deviations
 - b = 2: 12.76
 - b = 3: 35.00
 - b = 4: NA, couldn't get an observation of nonzero X for the hit-or-miss estimator

so, as b gets bigger, the number of observations above zero tends to become a rare event (at least, with the distributions we are using).

The relative error gets really big. Taking 10 times as much samples (100000), we get for b = 4:

```
REPORT on Tally stat. collector ==> HIT-OR-MISS {a= 0.0, b= 4.0, k= 1.0}
      num. obs.      min      max      average      standard dev.
      100000      0.000      3.642      1.0E-4      0.019
95.0% confidence interval for mean (student): (   -1.4E-5,    2.2E-4 )
```

```
REPORT on Tally stat. collector ==> IS {a= 0.0, b= 4.0, k= 1.0}
      num. obs.      min      max      average      standard dev.
      100000      3.7E-12      1.0E-3      2.3E-4      2.1E-4
95.0% confidence interval for mean (student): (    2.3E-4,    2.3E-4 )
```

As expected, the efficiency of the IS estimator is much better than the hit-or-miss. Its variance is much lower, at the cost of perhaps having trouble sometimes to figure out how to truncate (if possible at all).