

Spring 2019 CE 93 Midterm 1 (Hansen)

Answer all questions. Show your work and show what you know even if you cannot complete a question. Partial credit generously given.

1. Given a sample of  $x$  as the following,

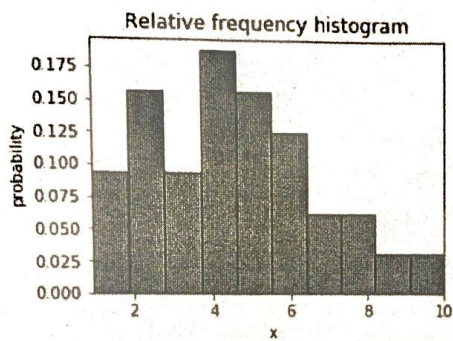
1, 3, 4, 5, 1, 2, 2, 3, 4, 5, 6, 7, 4, 5, 6, 4, 2, 4, 5, 6, 2, 1, 4, 6, 7, 5, 3, 2, 8, 8, 9, 10.

Given PYTHON expression,

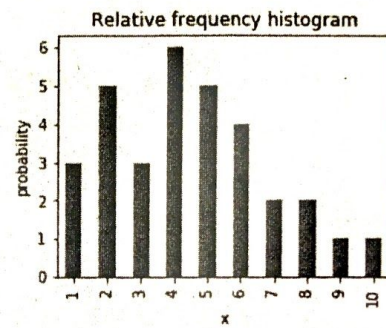
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plt.hist(x, bins=10, ec='black', weights=np.ones_like(x)/float(len(x)), histtype='bar')
```

Which of the following graph is generated by the python expression? (10 pts)

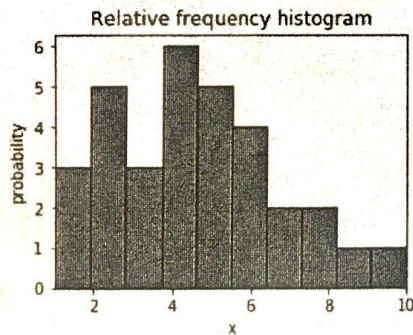
A.



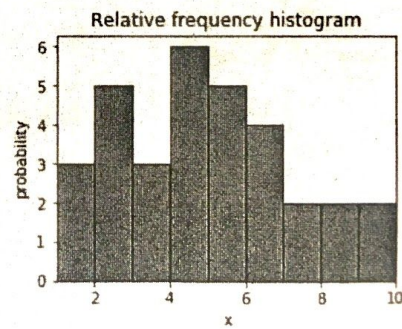
B.



C.



D.



2. Given the discrete distribution,

X	2	3	4	5	6	7	8
PMF	0.1	0.15	0.3	0.2	0.1	0.05	0.1

Which of the following PYTHON expressions returns the correct standard deviation of this distribution? (Note: identify **all** correct answers, if there is more than one.) (10 pts)

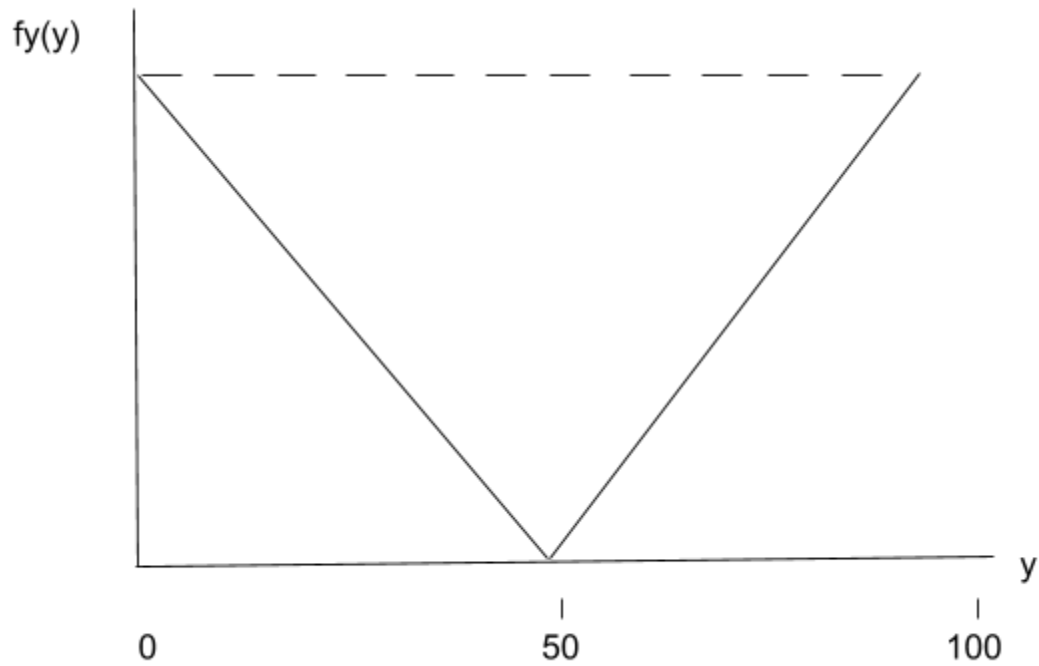
(1)	<code>np.std(x)</code>
(2)	<code>np.std(X*PMF)</code>
(3)	<code>(sum(X**2*PMF) - sum(X*PMF)**2)**0.5</code>
(4)	<code>(sum((X-sum(X*PMF))**2*PMF))**0.5</code>
(5)	<code>(sum((X-sum(X*PMF))*PMF))**0.5</code>

- A. (1)    B. (3)    C. (3)(4)    D. (2)(3)(5)

3. Two companies, A and B, fabricate steel beams. When subjected to a 10 kn point load test, 40% of A's beams fail and 10% of B's beams fail. Two beams from one of the two companies are tested. If it is equally likely that the beams come from either company:

- What is the probability that the first beam fails? (8 pts)
- If the first beam fails, what is the probability that it is from company A? (8 pts)
- What is the probability that both beams will fail? (8 pts)
- If the first beam fails, what is the probability that the second beam fails? (8 pts)
- Let  $X$  be the number of beams that fail the test. Let  $p(x)$  be the PMF for  $X$ .
  - What is  $p(0)$ ? (2 pt)
  - What is  $p(1)$ ? (2 pt)
  - What is  $E(X)$ ? (2 pt)
  - What is  $VAR(X)$ ? (2 pt)

4. The PDF for final exam scores (ranging from 0 to 100) for a large class has the shape shown by the solid line below. Outside the range 0-100, the PDF is zero.



- What is the formula for this PDF? (8 pts)
- What is the formula for the associated CDF? (8 pts)
- What is the sign of the skewness coefficient? Explain your reasoning. (8 pts)
- What is the probability that four students, chosen at random, each receive a score between 25 and 75 on the exam? (8 pts)
- Explain, in words, what seems to have happened in the final exam. (8 pts)