1-5. Events A, B are said to have \( P(A) = 0.8, P(B) = 0.4 \).

1. If \( P(A \cap B) = 0.3 \) then \( P(A \cup B) = P(A) + P(B) - P(A \cap B) \)
   a) 0.9  b) 0.32  c) 0.4  d) 0.37  e) 0.5
   \[ 0.9 = 0.8 + 0.4 - 0.3 \]

2. If \( P(A \cap B) = 0.3 \) then \( P(B \mid A) = \frac{P(A \cap B)}{P(A)} \)
   a) 0.9  b) 0.32  c) 0.4  d) 0.37  e) 0.5 (closest answer)
   \[ \frac{0.3}{0.8} = 0.375 \]

3. If \( P(A \cap B) = 0.3 \) then \( P(A \cap B^c) = P(A) - P(A \cap B) \)
   a) 0.9  b) 0.32  c) 0.4  d) 0.37  e) 0.5
   \[ 0.8 - 0.3 = 0.5 \]

4. If \( P(B \mid A) = 0.4 \) then \( P(A \mid B) = \frac{P(A \cap B)}{P(B)} \)
   a) 0.9  b) 0.32  c) 0.4  d) 0.37  e) 0.5
   \[ \frac{0.3}{0.4} = 0.8 \]

5. If A, B are independent then \( P(B \mid A) = P(B) \)
   a) 0.9  b) 0.32  c) 0.4  d) 0.37  e) 0.5

6-10. Given the following:

\[ \begin{array}{c|c|c}
\text{OIL} & + & 0.6 \\
\hline
0.4 & - & \text{OIL} - 0.2 \cdot 0.4 = 0.08 \\
\hline
0.1 & + & \text{OIL}^c + 0.8 \cdot 0.1 = 0.08 \\
\hline
0.8 & - & \text{OIL}^c - 0.8 \cdot 0.9 = 0.08 \\
\end{array} \]

\[ \frac{0.08 + 0.12 + 0.08 + 0.72}{4} = 0.37 \]
6. \( P(+) \mid \text{OIL} = 0.6 \)
   a) 0.6  b) 0.06  c) 0.2  d) 0.12  e) 0.7

7. \( P(\text{OIL } \cap \text{and } +) = \)
   a) 0.6  b) 0.06  c) 0.2  d) 0.12  e) 0.7

8. \( P(+) = \)
   \( \frac{P(\text{OIL}) P(+) \mid \text{OIL}}{P(+) \mid \text{OIL}} = 0.2 \times 0.6 = 0.12 \)

9. \( P(\text{OIL}) \mid \text{if +} = \)
   a) 0.6  b) 0.06  c) 0.2  d) 0.12  e) 0.7

10. Suppose that: Cost to test is 30.
    Cost to drill is 100.
    Gross return from drilling for oil, when it is present is 1000.

    For the contingency \( \text{OIL}^c + \) determine the NET return from the policy:
    "test, but only drill if the test is +"
    \( \alpha \) \( \text{OIL}^c + \) -30 -100 + 0
    TEST DRILL NO
    \( \text{OIL}^c + \)
    a) -30  b) -130  c) -200  d) 870  e) 970

11-13. A random variable \( X \) has the following probability distribution:

\[
\begin{array}{c|c|c|c}
 x & p(x) & x^2 p(x) \\
 0 & 0.4 & 0 \\
 1 & 0.2 & 0.2 \\
 2 & 0.4 & 0.8 \\
\end{array}
\]

11. \( P(X > 1) = \)
   a) 0.1  b) 0.5  c) 0.4  d) 0.6  e) 0.9

12. \( E X = \)
   a) 2.5  b) 0.9  c) 1.5  d) 0.8  e) 1

13. Variance \( X = E X^2 - (E X)^2 = 1.8 - 1^2 = 0.8 \)
   a) 1  b) 0.6  c) 1.4  d) 2  e) 0.8
14-16. One play of a lottery has random return $Y$ with:

- $EY = 4$.
- $\text{Variance } Y = 9$ (so standard deviation $= 3$).

14. Determine the expected total return from 100 independent plays.
   - a) 400  
   - b) 20  
   - c) 0.03  
   - d) 200  
   - e) 300

\[ E(\sum_{i=1}^{100} Y_i) = 100 EY = 400 \]

15. Determine the Variance of the total return from 100 independent plays.
   - a) 400  
   - b) 60  
   - c) 100  
   - d) 2000  
   - e) 900

\[ \text{Var}(\sum_{i=1}^{100} Y_i) = 100 \text{Var}(Y) = 900 \]

16. The probability distribution of the total return from 100 independent plays is approximated by a bell curve. What are the mean and standard deviation (not variance) of this bell curve?
   - a) (400, 400)  
   - b) (400, 900)  
   - c) (0.04, 20)  
   - d) (400, 30)  
   - e) (400, 60)

\[ \text{SD TOTAL} = \sqrt{900} = 30 \]

17. (unrelated to above) Here is a sketch of a bell curve with mean 20 and standard deviation 4. What is the approximate probability of the interval [20-8, 20+8]? Use the rule of thumb given in lecture for the probability captured by any bell curve within two standard deviations of its mean.

\[ a) \ 0.46 \quad b) \ 0.68 \quad c) \ 0.95 \quad d) \ 0.75 \quad e) \ 0.5 \]