1. Write the expectation of a random variable (r.v.) \( Z \), \( E(Z) \), extensively
   a) for a discrete random variable
   b) for a continuous random variable

2. \( Var(Z) \) can be written as \( E(Y) \). What is \( Y \)?

3. Write \( Var(Z) \) extensively
   a) for a discrete random variable
   b) for a continuous random variable

4. What does the cumulative density function or cumulative distribution function (c.d.f.) tell you?
   \( F_X(x) = \)

5. \( X \) is a continuous r.v.. How are the c.d.f. \( F_X(x) \) and the density function (d.f.) \( f_X(x) \) related?

6. \( Cov(X, Y) \) can be written as \( E(Z) \). What is \( Z \)?

7. Write \( Cov(X, Y) \) extensively for \( X \) and \( Y \)
   a) as discrete r.v.s.
   b) as continuous r.v.s.

8. Express \( E_{XY}(XY) \) as a function of \( Cov(X, Y) \)

9. Write \( E_{XY}(XY) \) extensively for \( X \) and \( Y \)
   a) as discrete r.v.s.
   b) as continuous r.v.s.

10. \( g(X) \) denotes a measurable function of the r.v. \( X \) (like e.g. \( X^2 \), \( ln(X) \)).
    Write extensively \( E(g(X)) \) for the continuous r.v. \( X \)

11. \( X \) and \( Y \) are cont. r.v.s.. \( Z = g(X, Y) \) is a measurable function. Write extensively \( E(g(X, Y)) \)

12. \( X \) and \( Y \) are cont. r.v.s.. What does the joint c.d.f. \( F_{XY}(x, y) \) tell you?
    Write the c.d.f. extensively. What does the joint p.d.f. \( f_{XY}(x, y) \) tell you?
    (discrete case)

13. How are \( F_{XY}(x, y) \) and \( f_{XY}(x, y) \) (joint density) related? (\( X \) and \( Y \) are cont. r.v.s.)

14. If \( X \) and \( Y \) are independent:
    \( F_{XY}(x, y) = \)
    \( f_{XY}(x, y) = \)

15. If \( X \) and \( Y \) are independent:
    \( E_{XY}(X \cdot Y) = \)
    \( Cov(X, Y) = \)
16. If $X$ and $Y$ are independent:
   $$E_{XY}(h(X) \ast g(Y)) =$$

17. $E_{XY}(X + Y) =$
   $$E_{XYZ}(X + Y + Z) =$$
   $$Var(X + Y) =$$

18. Write extensively for $X$ and $Y$ as discrete r.v.s. and $X$ and $Y$ as continuous r.v.s.
   $f_{X|Y}(X|Y = y)$
   $E_{X|Y}(X|Y = y)$
   $E_{X|Y}(X^2|Y = y)$

19. $E(aX) =$
   $$Var(aX) =$$
   $(a$ is a nonrandom scalar)

20. For $X = (X_1, X_2, \ldots, X_n)'$
   $E(X) = \mu, \mu =$?
   $Var(X) = \Sigma, \Sigma =$?
   $$A = \begin{bmatrix}
   a_{11} & a_{12} & \cdots & a_{1n} \\
   \vdots & \vdots & \ddots & \vdots \\
   a_{m1} & a_{m2} & \cdots & a_{mn}
   \end{bmatrix}
   (A$ is a nonrandom matrix)

   $Z = A \ast X$
   $E(Z) =$
   $Var(Z) =$

21. $Y = a + b \ast X$
   $E(Y)$ =
   $E(Y|X = x) =$

22. Given joint density $f_{XY}(x, y)$. How do you get $f_X(x)$ and $f_Y(y)$?
   a) as discrete r.v.s.
   b) as continuous r.v.s.

23. Under which circumstances can you get $f_{XY}(x, y)$ from $f_X(x)$ and $f_Y(y)$?

24. $X$ and $Y$ are jointly normally distributed
   $$\begin{pmatrix} X \\ Y \end{pmatrix} \sim BVN(\mu_X, \mu_Y, \sigma_X^2, \sigma_Y^2, \rho_{XY}).$$
   What is the relation of parameters and moments?
   $X$ ~
   $Y$ ~
   $X|(Y = y)$
   $Y|(X = x)$
   $E(X|Y = y) =$
   $Var(X|Y = y) =$

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25. $X, Y$ and $Z$ are normally distributed.

$W = a * X + b * Y + c * Z \sim$

How is $W$ distributed?