

CX 4240 Background Test Answers

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1 Probability and Statistics 1

1. A
2. $a^2 \text{Var}[X]$
3. $\frac{1}{n} \sum_{i=1}^n (X_i - \bar{X}_n)^2$ or $\frac{1}{n-1} \sum_{i=1}^n (X_i - \bar{X}_n)^2$ where $\bar{X}_n = \frac{1}{n} \sum_{i=1}^n X_i$ (either answer gets full score).
4. C
5.
$$f(x) = \begin{cases} 1 & \text{if } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$
6. C
7. D
8. $\frac{5}{36}$
9. TRUE
10. $1 - (1 - p^n)^m$

2 Probability and Statistics 2

1. C
2. C
3. TRUE
4. (1) 0; (2) $\beta_0 + \beta_1 x$
5. TRUE
6. B
7. FALSE
8. A
9. C
10. A

3 Linear Algebra

1. $m \times d$; $C_{ij} = \sum_{k=1}^n A_{ik} B_{kj}$
2. False
3. False
4. A
5. B, C, E
6. A
7. 2, 2 (each answer is worth 0.5 score.)
8. B, C, D
9. C
10. $\nabla f(x) = a$, $\nabla g(x) = 2(a^\top x)a$ (equivalent solution: $2(x^\top a)a$, $\nabla g(x) = 2aa^\top x$) (answers to $\nabla f(x)$ and $\nabla g(x)$ each is worth 0.5 score.)

4 Matlab

1. `[32 : 2 : 75]` or `[16 : 37] * 2`
2. `a = sqrt(x)` or `a = x.^(1/2)`
3. `x = power(x, y)` or `x = x.^y`
4. `a = A(1,:)`
5. `x(find(x > 0)) = 0` or `x(x > 0) = 0`
6. A, B, C, D
7. `[ 7 28; 14 35; 21 42 ]`
8. `[ 9 16 21; 24 25 24 ]`
9. `[ 1 0 1 1 0 ]`
10. `a = sum(x)`

5 Numpy

1. `array(range(32,75,2))` or `array(range(16,38))*2`
2. `a = sqrt(x)` or `a = power(x,0.5)` or `a = x ** 0.5`
3. `x = power(x, y)` or `x = x ** y`
4. `a = A[0]` or `a = A[0,:]`
5. `x[x > 0] = 0` or `x[where(x > 0)]=0`
6. A, B, C, D

7. `array([[ 7, 28], [14, 35], [21, 42]])`
8. `array([[ 9, 16, 21],[24, 25, 24]])`
9. `array([ True, False, True, True, False], dtype=bool)` or `array([ True, False, True, True, False])`
10. `a = sum(x)` or `a = x.sum()`