SECURITY SIMPLIFIED:

Deciphering Data Forensics into Accessible Actions

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Prevention

Mitigation

Detection

Enforcement

Systematic Security

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Workshop Objectives

- defining what preventative actions can be taken to deter anomalous testing behavior,
- defining what data forensic and statistical analyses could be run to address your testing programs unique needs (and how to interpret those findings in a useful way),
- providing guidance on defensible enforcement actions, and
- recommending mitigation strategies to implement at the exam and program level to decrease security issues in the future.

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Prevention

- Rapid and robust content development
  - Deep item banks
- Publication strategy and cadence that matches your exam audience and security concerns
- Alignment of policies across your program
- Delivery modality and selection of delivery providers
- SME and system protocols
- Verified credentials

What about you?

- What prevention strategies do you implement in your programs?

Mitigation

- Active monitoring of item, form, and candidate performance trends throughout the life cycle of exams and programs
  - Same exam across time
    - Review longitudinal data to determine exam specific next steps
  - Same program across exams
    - Review aggregate data to discuss programmatic patterns

Mitigation: Web Crawling

- Aides in the monitoring of stolen exam content that is available on the web
  - Availability and amount of exam content available on the web is clear and obvious evidence that content has been exposed
- May be used in conjunction with forensic analyses or used independently

Mitigation

- Breakout group activity

Mitigation

- Warning lights activated, now what?
  - Conduct targeted data forensics based on security concern
  - Revisit prevention strategies to take exam specific action
    - Content development
    - Form publication
    - Exam delivery
  - Adjust and communicate
    - Candidate policies
    - Delivery provider agreements
    - Test design details

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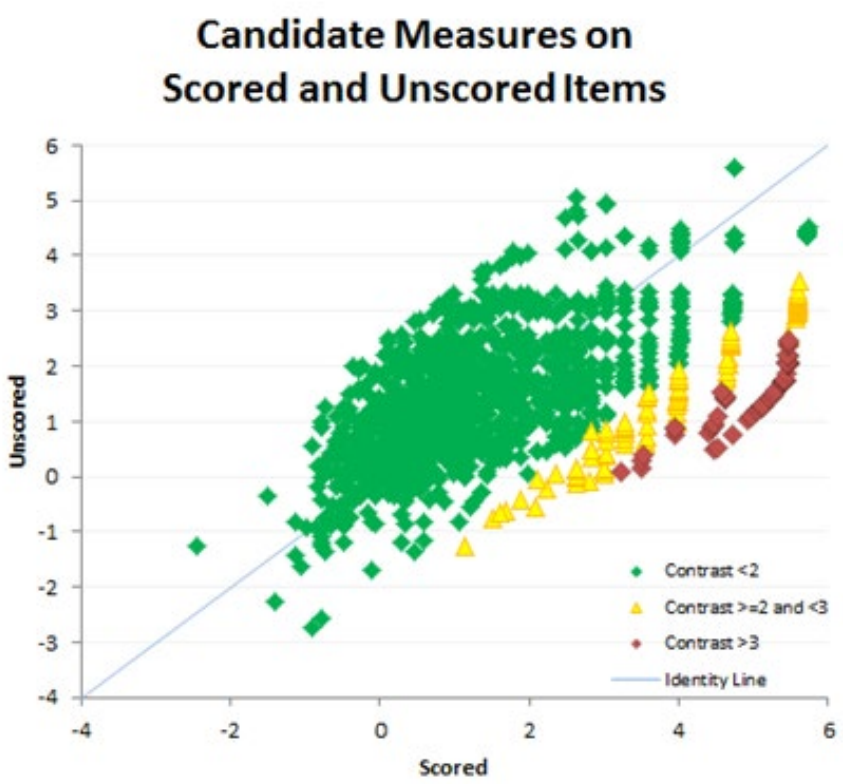
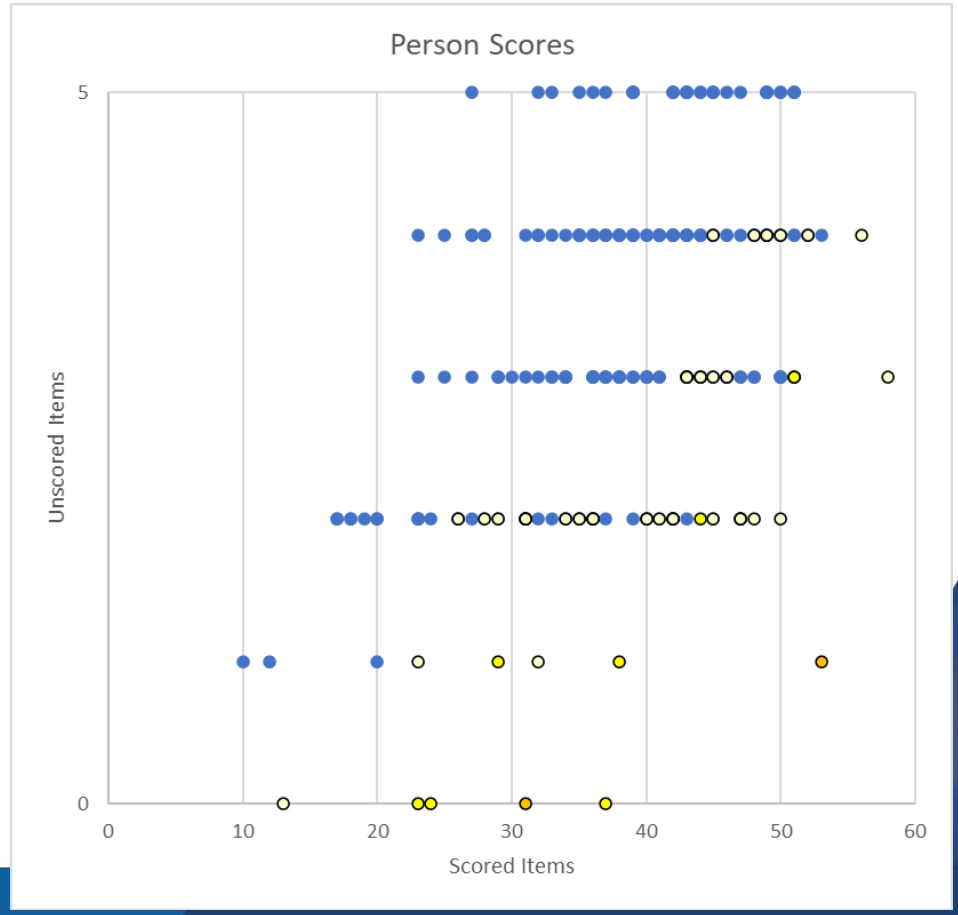
Data Forensics – Piracy and Access to Content

- Identification of Candidates' Pre-Knowledge
  - Differential Person Functioning (DPF)
  - Bivariate Score by Time (BST)
- Identification of Exposed Content
  - Differential Item Functioning (DIF)
  - Drift
  - Unscored-Only Analysis

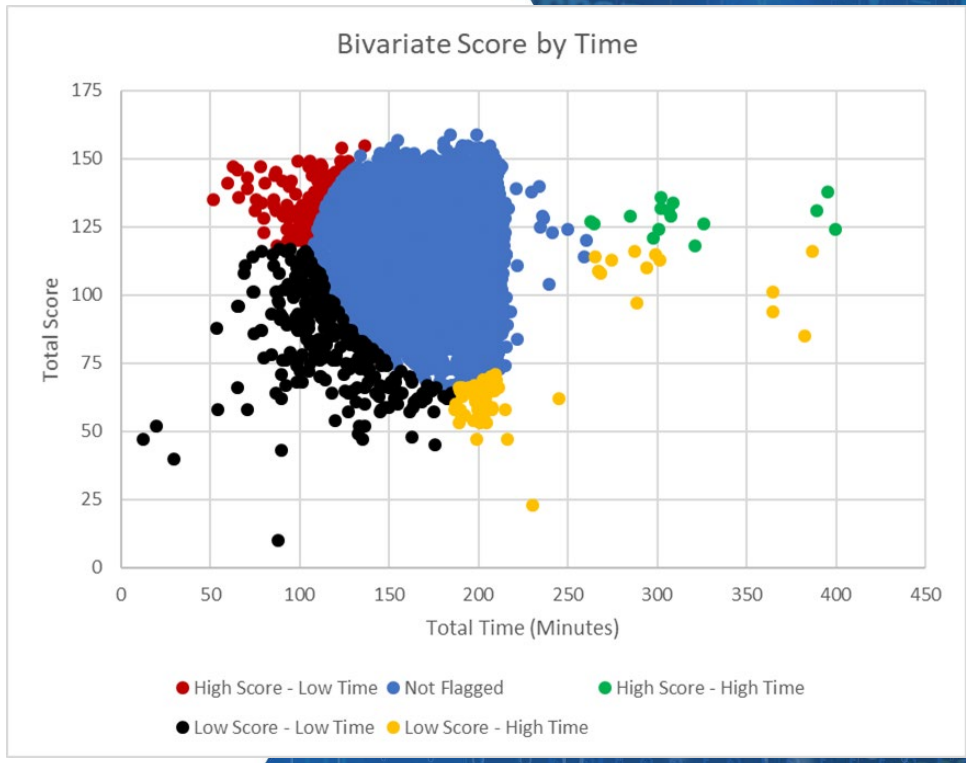
Item Class	Obs-Exp Avg.	DPF Measure	DPF S.E.	Item Class	Obs-Exp Avg.	DPF Measure	DPF S.E.	DPF Contrast	Joint S.E.	t	Welch d.f.	Prob.	Person Number	Name	Flags	Scored	Unscored	Test Time	Test Center
Sco_	0.03	-0.04	0.31	Uns_	-0.40	-3.40	1.96	3.36	1.99	1.690	4	0.1660	100	367363830|XX|ENU	Contrast >= 3.0	31	0	19.80	78721
Sco_	0.03	2.62	0.44	Uns_	-0.42	-0.63	1.38	3.25	1.45	2.240	4	0.0881	22	365893313|XX|ENU	Contrast >= 3.0	53	1	40.62	68291
Sco_	0.02	-0.69	0.31	Uns_	-0.22	-3.51	2.13	2.82	2.15	1.310	4	0.2606	122	367942087|XX|ENU	Contrast >= 2.0	24	0	27.95	73931
Sco_	0.03	0.93	0.31	Uns_	-0.40	-1.70	1.20	2.63	1.24	2.130	4	0.1007	132	368237937|XX|ENU	Contrast >= 2.0	38	1	38.10	66745
Sco_	0.04	1.56	0.34	Uns_	-0.42	-1.05	1.00	2.61	1.06	2.470	4	0.0688	30	365983046|XX|ENU	Contrast >= 2.0	44	2	72.45	82944
Sco_	0.02	0.08	0.3	Uns_	-0.28	-2.30	1.31	2.38	1.35	1.770	4	0.1521	208	370569806|UA|ENU	Contrast >= 2.0	29	1	76.57	200050218
Sco_	0.02	-0.79	0.31	Uns_	-0.28	-3.00	1.94	2.22	1.97	1.130	4	0.3230	71	366814457|XX|ENU	Contrast >= 2.0	23	0	18.83	66745
Sco_	0.02	0.54	0.32	Uns_	-0.27	-1.67	1.96	2.21	1.98	1.120	4	0.3273	104	367429031|US|ENU	Contrast >= 2.0	37	0	35.22	52897
Sco_	0.02	2.26	0.41	Uns_	-0.27	0.08	1.09	2.19	1.17	1.870	5	0.1199	143	368487409|XX|ENU	Contrast >= 2.0	51	3	20.70	62933
Sco_	0.03	1.67	0.34	Uns_	-0.32	-0.31	1.08	1.98	1.13	1.750	4	0.1544	185	370067225|XX|ENU	Contrast >= 1	45	2	35.68	66745
Sco_	0.02	4.15	0.74	Uns_	-0.22	2.18	1.10	1.96	1.33	1.470	8	0.1785	13	365753573|XX|ENU	Contrast >= 1	58	3	17.03	73152
Sco_	0.03	0.36	0.31	Uns_	-0.32	-1.58	1.19	1.94	1.23	1.580	4	0.1901	74	366836747|XX|ENU	Contrast >= 1	32	1	45.78	66745





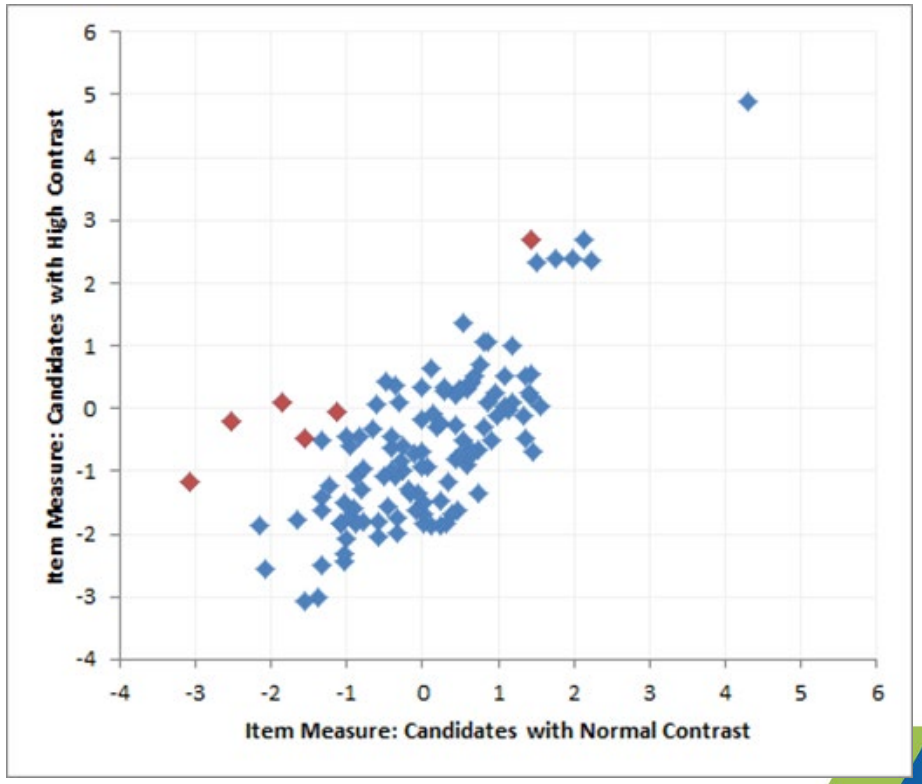
DPF

RegID	Date	Exam Time	Exam Score	Pass Fail	High Score Low Time	High Score High Time	Low Score Low Time	Low Score High Time	Flagging
XXXXXXXX	9/23/2019	51.90	135	1	0.0000	0.1549	0.0000	0.8451	High Score, Low Time
XXXXXXXX	9/4/2019	62.60	147	1	0.0000	0.0423	0.0000	0.9577	High Score, Low Time
XXXXXXXX	9/6/2019	59.90	141	1	0.0000	0.0854	0.0000	0.9146	High Score, Low Time
XXXXXXXX	9/27/2019	65.60	146	1	0.0000	0.0479	0.0000	0.9521	High Score, Low Time
XXXXXXXX	9/3/2019	66.10	136	1	0.0000	0.1412	0.0000	0.8588	High Score, Low Time
XXXXXXXX	8/11/2019	70.90	143	1	0.0000	0.0684	0.0000	0.9316	High Score, Low Time
XXXXXXXX	8/14/2019	70.70	139	1	0.0000	0.1053	0.0000	0.8947	High Score, Low Time
XXXXXXXX	9/26/2019	78.40	147	1	0.0000	0.0423	0.0000	0.9576	High Score, Low Time
XXXXXXXX	9/6/2019	75.50	135	1	0.0000	0.1549	0.0000	0.8451	High Score, Low Time
XXXXXXXX	10/9/2019	80.40	141	1	0.0000	0.0854	0.0000	0.9146	High Score, Low Time
XXXXXXXX	10/22/2019	285.10	129	1	0.2541	0.0000	0.7458	0.0000	High Score, High Time
XXXXXXXX	10/24/2019	301.00	124	1	0.3571	0.0000	0.6429	0.0000	High Score, High Time
XXXXXXXX	10/29/2019	264.60	126	1	0.3138	0.0003	0.6853	0.0006	High Score, High Time
XXXXXXXX	10/31/2019	308.60	134	1	0.1694	0.0000	0.8306	0.0000	High Score, High Time
XXXXXXXX	7/2/2019	210.20	66	0	0.8321	0.1667	0.0009	0.0002	Low Score, High Time
XXXXXXXX	7/6/2019	287.40	116	0	0.5422	0.0000	0.4578	0.0000	Low Score, High Time
XXXXXXXX	7/6/2019	200.30	58	0	0.7179	0.2819	0.0001	0.0001	Low Score, High Time
XXXXXXXX	7/8/2019	207.00	69	0	0.7981	0.1999	0.0016	0.0004	Low Score, High Time
XXXXXXXX	7/1/2019	157.50	64	0	0.1341	0.8651	0.0001	0.0006	Low Score, Low Time
XXXXXXXX	7/1/2019	98.70	68	0	0.0003	0.9980	0.0000	0.0016	Low Score, Low Time
XXXXXXXX	7/1/2019	78.30	87	0	0.0000	0.9655	0.0000	0.0345	Low Score, Low Time
XXXXXXXX	7/1/2019	12.60	47	0	0.0000	1.0000	0.0000	0.0000	Low Score, Low Time
XXXXXXXX	7/1/2019	65.40	96	0	0.0000	0.9009	0.0000	0.0991	Low Score, Low Time



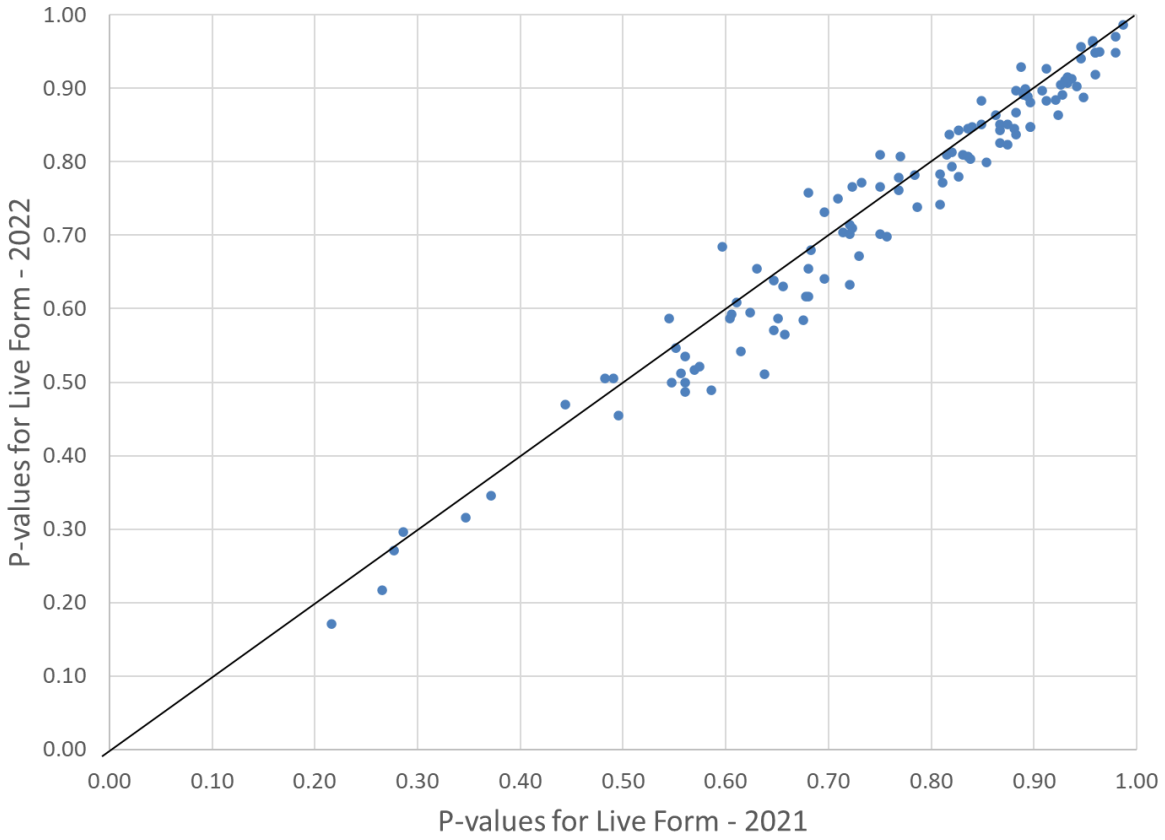
BST

Person Class	Obs-Exp Avg.	DIF Measure	DIF S.E.	Person Class	Obs-Exp Avg.	DIF Measure	DIF S.E.	DIF Contrast	Joint S.E.	t	Welch d.f.	Prob.	M-H Chi-square.	M-H Prob.	Size	Item Number
FL	0.03	-3.01	0.58	UN	-0.02	-1.42	0.19	-1.59	0.61	-2.600	272	0.010	1.704	0.192	-0.97	1
FL	-0.08	1.96	0.14	UN	0.05	1.36	0.11	0.59	0.18	3.230	479	0.001	3.595	0.058	0.43	2
FL	0.05	-3.42	0.71	UN	-0.03	-1.19	0.17	-2.23	0.73	-3.050	252	0.003	1.388	0.239	-1.19	3
FL	0.00	-0.60	0.19	UN	0.00	-0.66	0.14	0.06	0.24	0.240	547	0.812	0.005	0.943	-0.08	4
FL	0.08	-0.42	0.18	UN	-0.05	0.51	0.12	-0.93	0.22	-4.330	482	0.000	25.069	0.000	-1.37	5
FL	-0.06	0.44	0.11	UN	0.04	-0.23	0.09	0.67	0.14	4.710	INF	0.000	15.568	0.000	0.76	6
FL	-0.07	0.45	0.15	UN	0.04	-0.28	0.14	0.73	0.21	3.530	528	0.001	4.013	0.045	0.53	7
FL	-0.29	1.71	0.14	UN	0.17	-0.89	0.16	2.60	0.21	12.130	598	0.000	91.989	0.000	2.40	8



DIF

Client Item ID	Beta - 2020	Live Form A -2021	Live Form A - 2022	Difference
1	0.62	0.61	0.59	-0.01
2	0.69	0.77	0.81	0.04
3	0.83	0.73	0.77	0.04
4	0.75	0.70	0.73	0.04



Drift

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Data Forensics – Candidate Conduct

- Collusion among test takers
  - Response Similarity Index (RSI) Analyses
  - Score Similarity Index (SSI) Analyses
  - Cluster Analyses
- Proxy Test Taking
  - Flags from delivery provider
  - Behavior analyses
  - Proctoring information
  - Collusion analyses

Similarity Indices with Clustering

Form	Total No. of Candidate Records	Total No. of Pairs Analyzed	No. of Flagged Pairs	Percent Flagged Candidate Pairs	No. of Unique Candidate Records Flagged	Percent Flagged Candidate Records	No. of Clusters
A	4,883	11,919,403	536	0.004%	281	5.75%	97
B	4,828	11,652,378	323	0.003%	247	5.12%	94

Enforcement

- Consult with legal
- Establish written security policy
- Require candidate agreements
- Establish candidate appeals process
- Conduct comprehensive data forensics
- Triangulate multiple sources evidence of anomalous behavior prior to taking action

What about you?

- What enforcement actions do you implement in your programs?

Enforcement Actions

- Warning email
- Require review prior to exam/certification results being available
- Restriction on future registration
- Exam status change
- Credential status change
- Add to watch list
- Add to banned list

Let's apply what we learned…

- Large Group Activity

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Key Takeaways

- Document security prevention, mitigation, detection, and enforcement policies
- Consult with your legal team/advisors on planned security policies and prior to taking any actions against candidates, test centers, etc. based on data forensic results
- Be transparent with candidates regarding security policies (high-level is sufficient)
- Candidate agreements should be in-line with document policies and processes
- Candidates should have opportunity and means to appeal/challenge actions taken as a result
- Triangulate multiple sources of evidence of anomalous behavior prior to taking action
- Do not target data forensic techniques at a particular subset of candidates (e.g., region, test center, training program); all candidates should be treated fairly within a security analysis
- Continual evaluation of exam and program to determine when action should be taken

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Questions? Please reach out as questions arise.
We would love to discuss all things security!

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