Reliability & Risk Division
ASQ Excellence Through Quality®

Reliability & Risk Newsletter
March 2025 Edition

Page **CONTENTS**

Check out our website at:
https://my.asq.org/communities/home/182

Chair's Message

Rong Pan
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Dear Reliability and Risk Division (RRD) Members,

I hope this message finds you well. As we step into 2025, I want to take a moment to reflect on our division's successes over the past year and share some key updates for the months ahead.

One of the highlights of 2024 was our Machine Learning for Reliability Data Analysis pre-conference workshop at the RAMS 2025 conference in January. This workshop attracted over 40 attendees – our highest participation to date!

The overwhelmingly positive feedback reaffirmed the growing interest in machine learning applications in reliability engineering. Looking ahead, I encourage you to stay engaged with RAMS 2026, which will take place in Las Vegas in January next year. More details can be found at http://rams.org.

Beyond RAMS, RRD is expanding its conference sponsorships this year:

• RMMR 2025: Hosted in Charlotte, NC, this July, RMMR will explore the theme "Safety through Reliability." The abstract submission window is open until April. Visit https://asqrrd.org/rmmr_conference/ for more details.

• RAMS Europe 2025: Co-sponsored by ASQ RRD and IEEE Reliability Society, this August conference in Amsterdam, Netherlands, brings the reliability community together on an international stage. Learn more at http://rams-europe.org.

On the financial front, RRD had a strong 2024, generating a net profit of over $27K. This financial stability allows us to continue offering valuable resources, such as free webinars, RU credits, and discounted conference registrations.

However, we face a challenge familiar across ASQ divisions: declining membership. Our total membership dropped from 7,374 to 7,118, aligning with broader ASQ trends. Since ASQ operates under an open technical division policy – where members can join any division at no extra cost – I encourage you to invite your ASQ colleagues and friends to become part of RRD.

Our division continues to provide high-value professional development opportunities, and we remain committed to expanding our reach and impact in 2025. Thank you for your continued support—let's make this another successful year!

Reliability & Risk Division
ASQ Excellence Through Quality

ASQ RRD in RAMS 2025

The RAMS25 conference marks a significant milestone in the history of advocating practical reliability engineering and safety, celebrating 70 years of excellence. The conference, held from January 27-30, 2025, in Miramar Beach, FL, focused on "R&M in the Era of AI"

1.The American Society for Quality (ASQ), particularly the Reliability and Risk Division (RRD), played a pivotal role as one of the co-sponsors. This year, ASQ RRD had a visible presence in the management committee and the board of directors

2. They sponsored a pre-conference courses: one on Machine Learning for Reliability Data Analysis instructed by Rong Pan, and another during the conference course on CRE preparation by Dave Auda. Mohammad Pourgol, an RRD member, was the keynote speaker for the International Workshop on Autonomous Systems Safety (IWASS 2025)

2. ASQ also had a booth at the conference expo, showcasing their contributions and engaging with attendees

All ASQ RRD members were present at the conference, and notably, all the division's Executive Committee (EC) members are ASQ Fellow members, which is an extraordinary achievement. The EC members for the term 2024-2025 include Rong Pan (Chair), Trevor Craney (Treasurer), Dave Auda (Chair-Elect), and Mohammad Pourgol (Secretary). Here's a photo of the EC members:

Ellis R. Ott Scholarships

Supporting Graduate Students in Applied Statistics and Quality Management

In honor of Dr. Ellis R. Ott, late professor at Rutgers University and a founder of ASQ, the Ellis R. Ott Scholarship program awards two scholarships annually of $7500 to graduate students enrolled in or accepted to a master's or doctoral program in the US or Canada in applied statistics or quality management or related fields.

This competitive scholarship aims to support students who are passionate about improving quality and advancing the field of statistics.

This program provides financial assistance to help graduate students achieve their educational and career goals, as well as opportunities to connect with other scholars and professionals in their field. During the last 26 years, scholarships totaling over $390,000 have been awarded to 67 deserving students. Apply at: https://www.ellisottscholarships.org

Reliability & Risk Division
ASQ Excellence Through Quality

Webinars and Webinar info

Upcoming ASQ RRD *Webinars*

Thursday, March 13, 2025, **12:00 P.M. EST (US & Canada)**
ASQ RRD series webinar: 4 out of 3 people do not like math-How to use stats to take your data to the next level, Presenter: Amy Campbell
Thursday, April 10, 2025, **12:00 P.M. Eastern Time (US & Canada)**
ASQ RRD series webinar: motion amplification, Presenter: Cory Burns

Thursday, May 8, 2025, **12:00 P.M. Eastern Time (US & Canada)**
ASQ RRD series webinar: Improve Reliability Faster Using TOP-TRIZ, Presenter: Zinovy Royzen

Calling all Webinar Authors!!

Dave Auda (davidauda@yahoo.com)

We would like to extend an invitation on behalf of the ASQ Risk and Reliability Division (ASQRRD). If you would be interested in being a presenter of an ASQRRD webinar, contact Dave Auda. Webinars run every 2nd Thursday of the month at noon EDT for 1 hour. The content should be something the attendees can use, Reliability-related knowledge, or skill.

Why present? A large potential audience that we invite, an additional entry to your resume demonstrating competence, refining your presentation skills, AND earning recertification points. If you need support in developing, preparing, or presenting at such an event, we can support you. Become a recognized subject matter expert!

Social Media Update

Tim Gaens (tim@asqrrd.org)

Facebook:
325 likes • 346 followers
LinkedIn:
Page: 1,111 followers
Group: 4,841 member

Twitter:
ASQ-RD Latinoamerica 319 Followers
ASQ Reliability Div 750 Followers

Reliability & Quality Software

FMEA · FRACAS · Fault Tree · Reliability Prediction RBD · RCM · Maintainability · Weibull · ALT

KEY HIGHLIGHTS

- Integrated suite
- Stand-alone tools
- FMEA, FMECA
- FRACAS, CAPA
- Fault Tree
- Reliability Prediction
- Reliability Block Diagram
- RCM, Maintainability
- Weibull
- ALT
- Browser-based
- On-premise or cloud-based
- Training and implementation
- Knowledgeable tech support
- Free, no install trial

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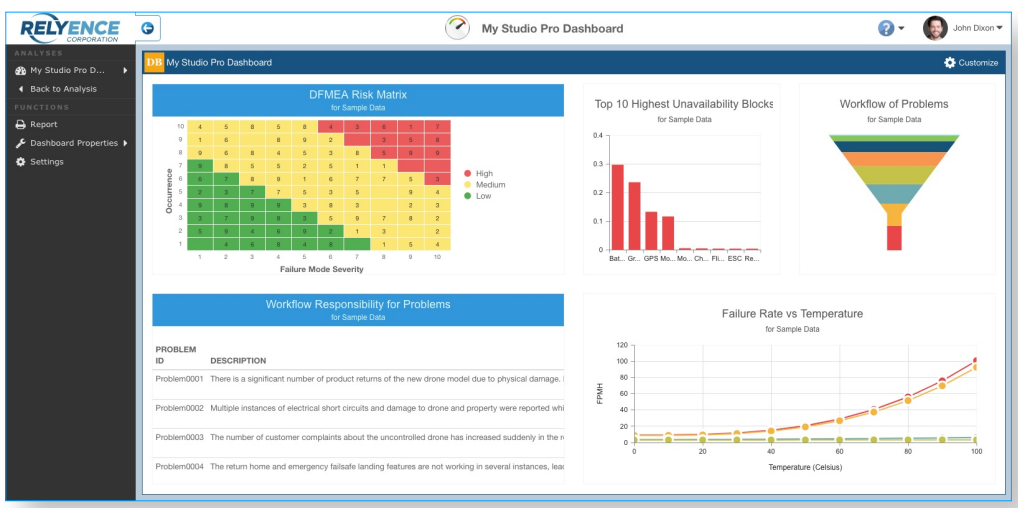
The Relyence Solution. Providing seamless integration between FMEA (including Process Flow Diagrams and Control Plans), FRACAS, Fault Tree, Reliability Prediction, RBD, RCM, Maintainability, Weibull, and ALT analyses, the Relyence tool suite empowers you to effectively manage your products throughout their lifecycle. You can use each module stand-alone, or combine the tools you need in our Relyence Studio integrated platform.

Power & Innovation. Relyence tools offer an impressive list of features. Just a few of the highlights include: customizable cross-module dashboards; user-interface customization; flexible report generation; data importing and exporting; API functionality; device libraries; workflow, approvals, and notifications; user and group roles and permissions; and Relyence innovations such *always-in-sync*™ technology, smart-layout, *Knowledge Banks*™ for lessons learned reusability, FMEA-Fault Tree *link-sync*™, and *Intelligent Part Mapping*™ for device decoding.



Flexibility & Collaboration. All Relyence tools can be accessed from any computer, PC, Mac, laptop, tablet, or smartphone for ultimate flexibility and team collaboration. You can use Relyence either as an on-premise installation on individual computers or a network, or as a zero-client, browser-based platform with your data hosted in the Microsoft cloud or in your own private cloud. The choice is yours!

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CALL FOR PAPERS, TUTORIALS & PRESENTATIONS

Theme: "Reliability Foundations"

August 6-7, 2025 | Marriott Hotel Amsterdam, The Netherlands

The **Reliability & Maintainability Symposium (RAMS® Europe)** is a spinoff from the well-known conference that has taken place in the United States for many years. We invite you to join us in Amsterdam for this landmark event, marking the first-ever expansion into Europe. This symposium is an in-person-only event. It will provide a dynamic platform for sharing ideas, innovations, and advancements in R&M practices and research. The theme of RAMS® EUROPE 2025, **"Reliability Foundations"**, emphasizes the core principles, methodologies, and advancements across diverse industries and applications.

RAMS® Europe 2025 is co-sponsored by the ASQ Reliability and Risk Division (RRD) and the IEEE Reliability Society (RS), offering a balanced mix of industrial and academic expertise. The event will also feature a pre-conference course on August 5, providing an in-depth introduction to core R&M principles and methodologies.

Important Deadlines

- **Abstract/Paper/Tutorial Submission:** 17 Mar 2025
- **Notification of Acceptance:** 28 Apr 2025
- **Final Submission of Paper/Slide/Poster/Tutorial:** 26 May 2025
- **Author registration:** 26 May 2025
- **Late Registration Rate Starts:** 16 Jul 2025

Why Participate in RAMS® Europe?

- Showcase groundbreaking research, case studies, success stories, and lessons learned in the field of R&M.
- Contribute to the advancement of R&M disciplines while engaging with global leaders and peers in reliability, maintainability, and related domains.
- Participate in expert tutorials, peer-reviewed paper presentations, and insightful discussions on practical applications and state-of-the-art technologies.

What We Are Looking For:

- **Regular Papers**: Peer-reviewed papers documenting advancements in R&M research and practice. Accepted papers will be presented during the symposium and submitted to *IEEE Xplore*. Each paper includes a 20-minute presentation and discussion session.
- **Tutorials**: Comprehensive, two-hour sessions covering fundamental or advanced R&M topics. Tutorials should equip attendees with practical knowledge for their professional work.
- **Presentations Only**: A great platform to share insights without pursuing formal publication. These presentations follow the same format as paper presentations.
- **Abstracts & Posters**: Ideal for sharing preliminary findings, innovative concepts, or ongoing research in a concise format.

Topics of Interest

Submissions should address relevant topics in R&M that align with the symposium's goals. Suggested topics include, but are not limited to:

- Design Optimization Using R&M Techniques
- Diagnostics, Prognostics & Health Management (PHM)
- Accelerated Life Testing, Life/Warranty Data Analysis
- Reliability Modelling/Physical Reliability Models
- Availability, Repairable Systems and Maintenance Models and Methodologies
- Human Reliability and System Safety Analysis
- FMEA and Fault Tree Analysis
- Risk Analysis, Risk Management, and Security in Systems
- Software/AI Reliability, Testing, and Dependability
- Structural Reliability and Fatigue Life Prediction
- Autonomous Systems, Big Data, and IoT Applications in R&M
- R&M Applications in Aerospace, Healthcare, Manufacturing, and Infrastructure
- Business Process Improvement and R&M Management

Join Us in Amsterdam: We look forward to welcoming you to Amsterdam for this exciting new chapter in RAMS® history! For more information and submission details, visit: http://rams-europe.org

2025 RELIABILITY, MAINTENANCE & MANAGING RISK CONFERENCE (RMMR 2025)

July 17-18, 2025, Charlotte, North Carolina

Call for Abstracts

Safety through Reliability

We invite you to submit abstracts for the presentations at the 5th Annual Reliability, Maintenance & Managing Risk Conference (RMMR 2025) to be held on July 17-18, 2025 (with pre-conference courses to be offered on July 16), in Charlotte, NC. RMMR 2025 is sponsored by the American Society for Quality (ASQ), Reliability and Risk Division (RRD). It is a forum for the quality and reliability practitioners, asset and risk managers, statisticians, and academic researchers to come together to share and learn from each other. The goal of this conference is to discuss and disseminate practical tools and methods for reliability improvement and risk reduction in industry, service, military, government, and non-profit sectors. Topics include but are not limited to the following:

- Reliability Modeling
- Lifetime Analysis
- Accelerated Testing
- Reliability Growth
- Repairable Systems Analysis
- Root Cause Analysis
- Software Reliability
- Hazard, Risk, and Resilience Analysis
- Product Planning for Quality and Reliability
- Prognostics and Health Management
- Maintenance Models and Methodologies
- System Reliability Modeling and Analysis
- Risk Modeling and Asset Management
- ML and AI for Reliability and Safety
- Big Data and IoT Applications
- Experimental Designs for Reliability Data

If you are interested in presenting an applied or expository paper or case study in any of these topics, please submit an abstract online or email it to the program chair listed below. Please follow the suggested abstract format and indicate the expected competence level of your presentation. The presentations are expected to be in the format of technical talks lasting 30 minutes each. However, the program committee welcomes submissions of longer durations (e.g., 45 or 60 minutes) or in tutorial or workshop formats. Please contact the conference chair or the program chair for workshop or tutorial proposals.

Keynote speaker: To be announced.

Abstract Submission Deadline	March 28, 2025
Notification Date	April 25, 2025

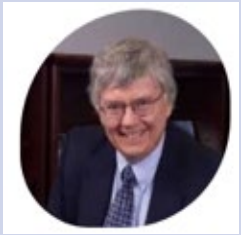
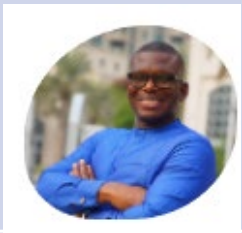
Conference Chair: David Auda
Georgia Pacific, Darlington, SC, USA
davidauda@yahoo.com

Program Chair: Arda Vanli, PhD
Florida A&M University, Florida State University,
College of Engineering, Florida, USA
oavanli@eng.fsu.edu

Conference info and abstracts submission:
http://www.asqrrd.org/rmmr_conference

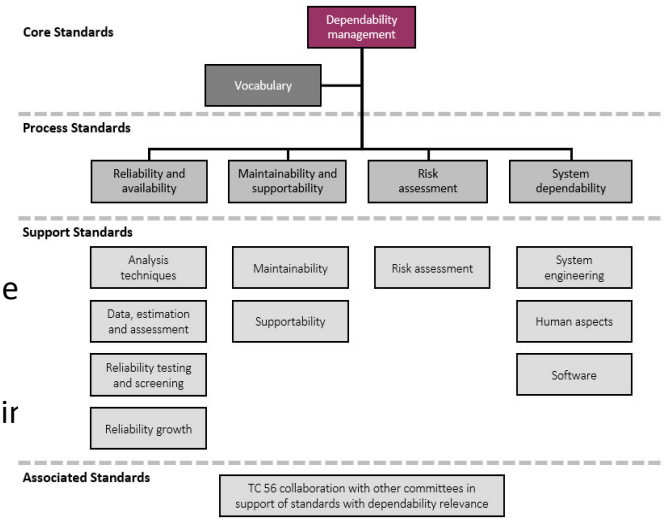
Conference venue: Embassy Suites by Hilton Charlotte Uptown

ASQRRD 2024-2025 Active Volunteers

	Rong Pan Division's Chair RAMS Management Committee Rong.pan@asu.edu		Mohammad Pourgol Division Secretary, Instructor, Newsletter Co-editor. mpourgol@umd.edu
	Dave Auda Division's Chair-Elect Webinars Exec Producer, Instructor davidauda@yahoo.com		Trevor Craney RAMS Board of Directors Division Treasurer Instructor treasurer@asqrrd.org
	Tim Gaens Webmaster, Social Media Manager tim@asgrrd.org		Jim Breneman, Instructor Newsletter Co- Editor weibullman@gmail.com
	Carol Parendo RAMS Management Committee Carol.parendo@collins.com		Mindy Hotchkiss RAMS Board of Directors mindyhotchkiss@gmail.com
	Tamunoteyim "Tammy" Karibo Website support, Social Media Manager tammy.karibo@gmail.com		Angleat Shelikkoff Marketing Manager adshelikoff@gmail.com
	Pankaj Shrivastava RAMS Management Committee pankaj.shrivastava@halliburton.com		Yeshwanth Reddy Website support and Social Media Manager
	Jalal Raei Newsletter Content Provider raeejalal@gmail.com	Links to ASQ RRD Activities: https://asqrrd.org/ https://rams.org/ https://rams-europe.org/ https://asqrrd.org/rmmr_conference/	

IEC/TC 56 Standard: Dependability-Part 2

By Jalal Raei, Ph.D
raeejalal@gmail.com



Structure of TC 56 standards Parts:

•Core standards

Standards providing overview on dependability fundamentals, objectives or management

•Process standards

Standards giving guidance on a particular dependability issue related to an aspect of management or to a life cycle phase

•Support standards

Standards giving technical information of general relevance ir various dependability issues

•Core standards

1. Dependability Management

IEC 60300-1:2014: Dependability management – Part 1: Guidance for management and application

IEC 60300-1:2014 establishes a framework for dependability management. It provides guidance on dependability management of products, systems, processes or services involving hardware, software and human aspects or any integrated combinations of these elements. It presents guidance on planning and implementation of dependability activities and technical processes throughout the life cycle taking into account other requirements such as those relating to safety and the environment. This standard gives guidelines for management and their technical personnel to assist them to optimize dependability.

Now, this standard is undergoing its Ed 4.0 in progress revision and will be published in 2025.

2. Vocabulary

IEC 60050-192:2015: International Electrotechnical Vocabulary (IEV) - Part 192: Dependability

IEC 60050-192:2015 gives the general terminology used in the field of dependability. The terms are generic and are applicable to all fields of dependability methodology, including electrotechnical applications. The document is not an exhaustive vocabulary for all IEC standards in the dependability field: definitions for some specialized terms may only be found in the relevant standards. This document replaces sections 1 to 20 of IEC 60050-191:1990, which has been subjected to a systematic in-depth review and revision.

IEC 61703:2016: Mathematical expressions for reliability, availability, maintainability and maintenance support terms

IEC 61703:2016 provides mathematical expressions for selected reliability, availability, maintainability and maintenance support measures defined in IEC 60050-192:2015. In addition, it introduces some terms not covered in IEC 60050-192:2015. They are related to aspects of the system of item classes. According to IEC 60050-192:2015, dependability [192-01-22] is the ability of an item to perform as and when required and an item [192-01-01] can be an individual part, component, device, functional unit, equipment, subsystem, or system. To account for mathematical constraints, these standard splits the items between the individual items considered as a whole (e.g., individual components) and the systems made of several individual items. It provides general considerations for the mathematical expressions for systems as well as individual items but the individual items which are easier to model are analyzed in more detail with regards to their repair aspects. This standard is mainly applicable to hardware dependability, but many terms and their definitions may be applied to items containing software. This second edition cancels and replaces the first edition published in 2001.

Failure Rate and Reliability Calculation Given Failure Data

By Tamunoteyim Karibo, PE
tammy.karibo@gmail.com

FAILURE RATE

Every piece of equipment in a system will eventually fail if operated for a long enough period, leading to an associated failure rate. Some components have a high failure rate, while others experience failures infrequently.
Failure rate is the expected number of failures per unit within a specified time interval. It represents an average value rather than a fixed outcome. When calculating the failure rate for a group of units, the total operating time of all units should be used rather than chronological time. The formula is:

$$Failure\ Rate, \lambda = \frac{Number\ of\ Failures}{Total\ Operating\ Time\ of\ Units}$$

Example 1

Ten Compressor valves were tested for 500 hours and four transformers failed after the following test:

Time Period	Number of failed valves
After 50 hours	1
After 150 hours	1
After 400 hours	2

The failure rate of these types of compressor valve is calculated as follows
Total Operating time: (1x50 + 1x150 + 2x400 + 6x500) hours = 4000-unit hours

$$\lambda = \frac{4}{4000} = 0.001 \frac{failures}{unit} hour$$

RELIABILITY CALCULATION GIVEN FAILURE DATA

Consider the case in which a fixed number of identical components (N_O) are tested.
Let;
$N_S(t)$ = number of components surviving at time t
$N_F(t)$ = number of components failed at time t.
$N_O = N_S(t) + N_F(t)$
Reliability is the probability of not failing in a specified time interval. If the original population is N_O and N_F of them fail after time t, leaving $N_S(t)$ surviving, the reliability at time t, which is the probability of surviving is

$$R(t) = \frac{N_S(t)}{N_O} = \frac{N_O - N_F(t)}{N_O}$$

$$R(t) = \frac{N_S(t)}{N_O} = 1 - \frac{N_F(t)}{N_O}$$

$$\frac{dR(t)}{dt} = \frac{-1\ dN_F(t)}{N_O dt}$$

Failure Rate and Reliability Calculation Given Failure Data

By Tamunoteyim Karibo, PE
tammy.karibo@gmail.com

Cont.

The probability of Failure Q(t)

$$Q(t) = \frac{N_F(t)}{N_O}$$

Therefore R(t) + Q(t) = 1 (They are complementary)

If we define $\frac{-1\,dN_F(t)}{N_O dt}$ as the instantaneous failure density function which is the probability density function f(t) from which

$$\frac{-dR(t)}{N_O dt} = f(t)$$

By integrating both sides

$$\int_{R(0)}^{R(t)} -dR(t) = \int_0^t f(t)dt$$

$$1 - R(t) = \int_0^t f(t)dt$$

If failure rate is constant, then we can define:

$$\frac{dN_F}{dt} = \lambda N_S$$

Since we have

$$\frac{dR(t)}{dt} = \frac{-1\,dN_F(t)}{N_O dt} = -\lambda \frac{N_S(t)}{N_O} = -\lambda R(t)$$

$$\int \frac{1}{R} dR = -\int \lambda dt$$

$$\ln R(t) = -\lambda t$$

$$\boldsymbol{R(t) = e^{-\lambda t}}$$

$$\boldsymbol{Q(t) = 1 - R(t) = 1 - e^{-\lambda t}}$$

Example 2

In a large refinery, five thousand new Digital No Flow Transmitters (DNFTs) are placed into service, each with a constant failure rate of 0.1 per year.

a) How many of the original 5,000 units will remain in service after 10 years?

b) How many of the original units will fail specifically in Year 10?

a) Probability of Survival is given as $R(t) = e^{-\lambda t}$

In 10 years, the probability of survival will be

$$R(t) = e^{-\lambda t} = e^{-0.1\,(10)} = e^{-1.0} = 0.3679$$

Therefore, out of the original 5,000 units, 5000 x 0.3679 = 1839 should survive

b) Number of failures in 10 years = No. of Survivors after Year 9 – No. of Survivors after Year 10

$$5000\left(e^{-0.1(9)}\right) - 1839 = 194$$

Mar 2025

TECH SPOT: SAMPLE CRE QUESTIONS (Part 29)

1. The probability that a light switch will work at the nth demand is 0. 9999/n^(1/n). The switch is used 2 times per day. What is the probability that the switch will fail during the first five days following installation?

A. 0.068 B. 0.875 C. 0.932 D. 0.75

2. For the exponential distribution, any mean life value determines a life for a specified value of R; i.e., the reliable life may be established for any mean and desired reliability. Thus it is more meaningful to set a reliability goal in terms of a statement that a "0.xx reliability for 1000 cycles of operation is required". So, if the mean number of cycles to failure is 1000, what is the 0.95 reliability for 1000 cycles of operation?

A. 9491 cycles B. 6153 cycles C. 99499 cycles D. 19496 cycles

3. Suppose one knew that the failure process of a device was such that essentially all of the devices would fail before 10000 hours, but that 95% of the devices would operate beyond 2000 hours. Further, it is known that the failure times follow a normal distribution. In this case, it is known:

$\mu + 3\sigma = 10{,}000$ *and* $\mu - 1.645\sigma = 2000$

What is the mean and standard deviation for this normal distribution of failure times?

A . μ=4700, σ=1722, B. μ=4833, σ=1650, C μ=4833, σ=1722, D. μ=1722, σ=500,

4. What does Step-stress testing NOT do :

A. Tests initially at operating stress, then stress is increased step-wise
B. Increase stress level until failure
C. Used to project reliability in use condition
D. Plot failures as a function of stress-time

5. The times to failure for a machine used in surface mount technology follows a Weibull distribution with β=2, η=30 weeks. a) What is the probability of surviving 40 weeks? And
b) What is the probability of the machine failing in the interval (40,50) weeks?

A. 0.169, 0.4302 B. 0.169, 0.158 C. B. 0.169, 0.5625 D. B. 0.144, 0.4302

6. Using the rocket data in this table: Calculate the projected instantaneous failure rate at 1,000,000 seconds of maturity.

A. 0.85/100K sec B. 0.94/100K sec C. 0.75/100K Sec D. 1.32/100K Sec

Eng	Cum events	Cumulative System Seconds
0003	1	5000.
0004	2	11000.
0101	3	21000.
0006	4	50000.
0010	5	84000.
0204	6	126000.
2013	7	145000.
2208	8	162000.
2308	9	245000.

7. An engine bearing is redesigned due to multiple unbalance events. A Weibull distribution of the original bearing failures resulted in a β = 2 and η = 600 hours. You have 5 redesigned bearing systems to test. How long must you test these redesigned bearings to have a 90% confidence that the failure mode has been corrected?

A. 455 hrs. each B. 407 hrs. each C. 317 hrs. each D. 691 hrs. each

8. The PDF for the time-to-failure of an appliance is $f(t)=\frac{32}{(t+4)^3}$, $t>0$, where t is in years

Find the reliability $R(t)$, then using R(t), find the failure rate $\lambda(t)$.

A. $\lambda(t) = 2/(t+4)$ B. $\lambda(t) = 3/(t+4)$ C. $\lambda(t) = 1/(t+4)$ D. $\lambda(t) = 16/(t+4)$

9. The failure rate on a new brake drum design is estimated to be $\lambda(t)=1.2\times10^{-6}\exp(10^{-4}t)$ per set, where t is in kilometers of normal driving. Forty vehicles are each test-driven for 15,000 km. How many failures are expected, assuming that the vehicles with failed drives are removed from the test?

A. 1.5 B. 1.44 C. 2.12 D. 1.67

10. In fault tree analysis, what logic gate is represented by the probability expression of $P_T = P_1 + P_2 - P_1P_2$?

A. INHIBIT gate B. OR gate C. AND gate D. INHIBIT + OR gate