Started on	Sunday, 10 August 2025, 4:46 PM
State	Finished
Completed on	Sunday, 10 August 2025, 5:58 PM
Time taken	1 hour 11 mins
Grade	**34.00** out of 45.00 (**75.56**%)

Question 1

Correct

Mark 2.00 out of 2.00

What is the reliability of System B? [Answer format: percentage to one decimal places, e.g. 77.7]

Answer: 92.0 ✔

RB=1-(1-R1R3)(1-R2R4)

The correct answer is: 92.0

Question 2

Incorrect

Mark 0.00 out of 2.00

Which statement is UNTRUE?

Select one:

- a. A constant hazard rate for a component implies random failures.
- b. The failure probability of most components increases over time
- c. The reliability of a component is a function of time
- d. If the shape parameter of the Weibull distribution is smaller than 1, it indicates early life failures
- ⦿ e. A socket in a system is represents a repairable element of the system ✖
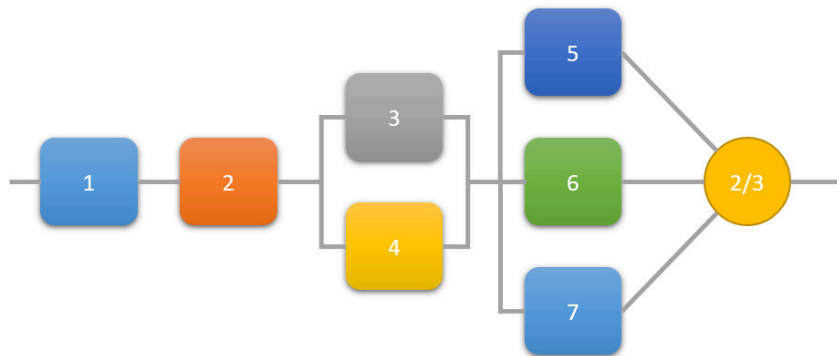
Your answer is incorrect.

The correct answer is: The failure probability of most components increases over time

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Question 3

Incorrect

Mark 0.00 out of 3.00

Consider the following system's RBD. The reliabilities of the components are: R_1=0.97; R_2=0.96; R_3=0.96; R_4=0.94; R_5=0.92; R_6=0.95; R_7=0.959. Calculate I_2. [Answer format: importance to four decimal places, e.g. 0.7777]

Answer: 0.9296 ✖

RS = R1*R2*(R3 + R4 – R3*R4)*(R5*R6 + R5*R7 + R6*R7 – 2*R5*R6*R7)

I2 = RS/R2 = R1*(R3 + R4 – R3*R4)*(R5*R6 + R5*R7 + R6*R7 – 2*R5*R6*R7) = 0.9590

The correct answer is: 0.959

Question 4

Correct

Mark 2.00 out of 2.00

What is the most appropriate acronym for: the use of appropriate integrated hardware and software systems to perform specialised design functions?

Select one:

- a.   HASS
- b.   HAZOPS
- c.   NHPP
- ⦿ d.   CAD ✔
- e.   SPC
- f.   HALT
- g.   FRACAS
- h.   DOE
- i.   RCM
- j.   FMECA
- k.   QFD
- l.   FTA
- m.   DMAIC
- n.   ANOVA

Your answer is correct.

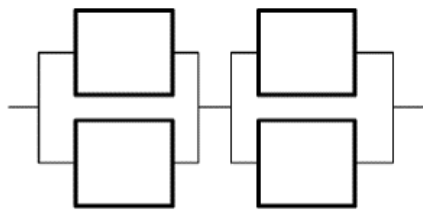The correct answer is: CAD

During the design of the 747 airplane, reliability engineers worked on the assumption that the 747 shall be able to perform all the necessary functions (take-off, cruise flight, landing, etc.) as long as at least one of the two engines on each wing is fully operational. The four engines are identical in all respects and each has a reliability of 0.95152 for 24 hour non-stop operation. Calculate the reliability of the propulsion system for a 24 hour flight.

[Answer format: reliability to four decimal places, e.g. 0.7777]

Answer: 0.9953 ✔

$R_{12}=R_{34}=1-(1-R_i)(1-R_i)$

$R_S=R_{12}R_{34}$

The correct answer is: 0.9953

What is the reliability of System A? [Answer format: percentage to one decimal places, e.g. 77.7]
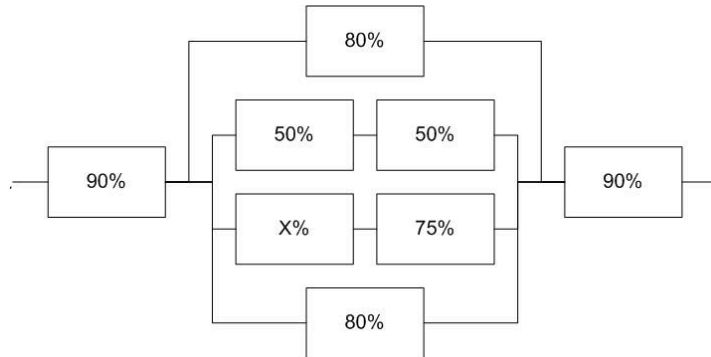
Answer: 94.3 ✔

$RA=(1-(1-R1)(1-R2))^*(1-(1-R3)(1-R4))$

The correct answer is: 94.3

Observe the system below. If the system are required to have an overall reliability of 70%, what should the reliability be for component "X"? Hint: Investigate different reliability scenarios, instead of trying to solve x

Select one:

- a. 72.45%
- b. 99.647%
- c. None of the other reliabilities
- d. 85.68%
- e. 10.567%
- f. Any of the other four reliabilities ✔

Your answer is correct.

The correct answer is:
Any of the other four reliabilities

Question 8

Incorrect

Mark 0.00 out of 2.00

Which item does not fit?

Select one:

- ○ a. Maintenance cost
- ◉ b. Optimal global time ✖
- ○ c. Maintenance duration
- ○ d. Replacement cost
- ○ e. Number of minimal repairs

Your answer is incorrect.

The correct answer is: Maintenance duration

What is the most appropriate acronym for: a method for discovering weaknesses which originate during the design and production phases of the product life cycle?

Select one:

- ○ a.   FMECA ✖
- ○ b.   HAZOPS
- ○ c.   DMAIC
- ○ d.   HALT
- ○ e.   CAD
- ○ f.   HASS
- ○ g.   DOE
- ○ h.   QFD
- ○ i.   SPC
- ○ j.   FRACAS
- ○ k.   RCM
- ○ l.   NHPP
- ○ m.   FTA
- ○ n.   ANOVA

Your answer is incorrect.

The correct answer is: HALT

Question 10

Correct

Mark 2.00 out of 2.00

What is the most appropriate acronym for: a method which at each stage of the product life cycle translate customer requirements into company requirements?

Select one:

- a. HAZOPS
- b. RCM
- c. HALT
- d. CAD
- e. DMAIC
- f. FMECA
- g. FTA
- h. FRACAS
- i. QFD ✔
- j. SPC
- k. NHPP
- l. HASS
- m. DOE
- n. ANOVA

Your answer is correct.

The correct answer is: QFD

Question **11**

Correct

Mark 2.00 out of 2.00

You are provided with the following data set of pump failures over time:

Failure Obs., i	Operating Time
1	11
2	25
3	42
4	56
5	76
6	101
7	129
8	161
9	209
10	291
11	302
12	327

What percentage of pumps have failed at t=42?
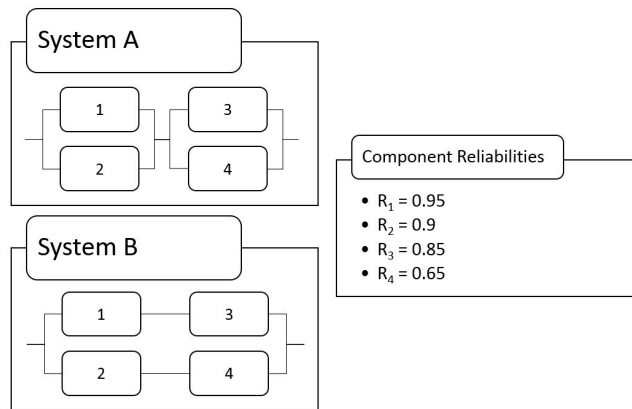
Select one:

- ○ a. 22.66%
- ○ b. 18.18%
- ○ c. 18.3%
- ○ d. 28.7%
- ○ e. 20%
- ⦿ f. 16.67% ✔

Your answer is correct.

The correct answer is: 16.67%

Information

Observe the RBD for System A and System B and answer the questions which follows.

System A

| 1 | 3 |
| 2 | 4 |

Component Reliabilities

- $R_1 = 0.95$
- $R_2 = 0.9$
- $R_3 = 0.85$
- $R_4 = 0.65$

System B

| 1 | 3 |
| 2 | 4 |

Let us consider a simplified version of a fire detector system located in a production room. The fire detector system is divided into two parts, heat detection and smoke detection. In addition, there is an alarm button that can be operated manually. The fire detector system can be described schematically, as shown in the figure below.

Heat Detection

In the production room there is a closed, pneumatic pipe circuit with four identical fuse plugs, FP1, FP2, FP3, and FP4. These plugs let air out of the circuit if they are exposed to temperatures higher than 72°C. The pneumatic system has a pressure of 3 bars and is connected to a pressure switch (pressostat) PS. If one or more of the plugs are activated, the switch will be activated and give an electrical signal to the start relay for the alarm and shutdown system. In order to have an electrical signal, the direct current (DC) source must be intact.

Smoke Detection

The smoke detection system consists of three optical smoke detectors, SDl, SD2, and SD3; all are independent and have their own batteries. These detectors are very sensitive and can give warning of fire at an early stage. In order to avoid false alarms, the three smoke detectors are connected via a logical 2-out-of-3 voting unit, VU. This means that at least two detectors must give fire signal before the fire alarm is activated. If at least two of the three detectors are activated, the 2-out-of-3 voting unit will give an electric signal to the start relay, SR, for the alarm and shutdown system. Again the DC voltage source must be intact to obtain an electrical signal.
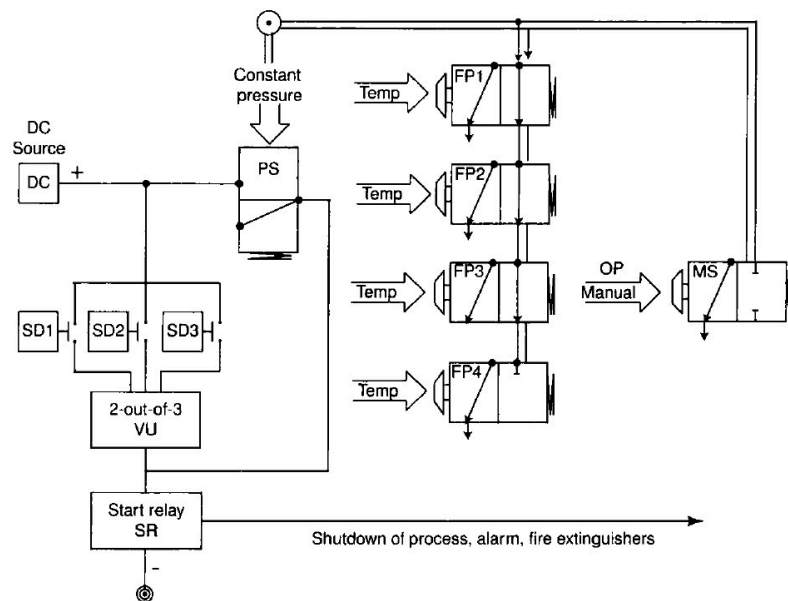
Manual Activation

Together with the pneumatic pipe circuit with the four fuse plugs, there is also a manual switch, MS, that can be turned to relieve the pressure in the pipe circuit. If the operator, OP, who should be continually present, notices a fire, he can activate this switch. When the switch is activated, the pressure in the pipe circuit is relieved and the pressure switch, PS, is activated and gives an electric signal to the start relay, SR. Again the DC source must be intact.

The Start Relay

When the start relay, SR, receives an electrical signal from the detection systems, it is activated and gives a signal to

- Shut down the process.
- Activate the alarm and the fire extinguishers.

Construct the RBD, by dragging and dropping the various element into position on the schematic. Note that some of the components are represented in more than one location in the diagram. It is therefore important to realise that a RBD is not a physical layout diagram for the system. It is a logic diagram, illustrating the function of the system. Further construct the RBD by starting with the input actions (i.e. operator, temp) from left moving right to the start relay. For active redundancy, start with the first component at the top, with the rest following sequentially.
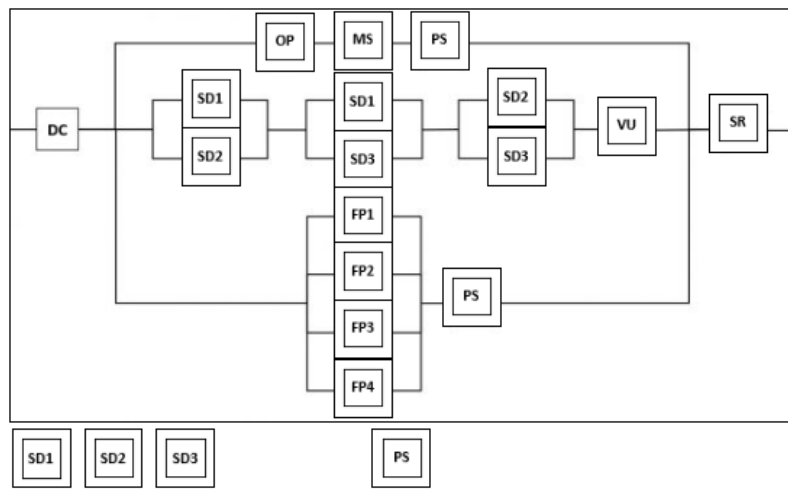
Correct answer:
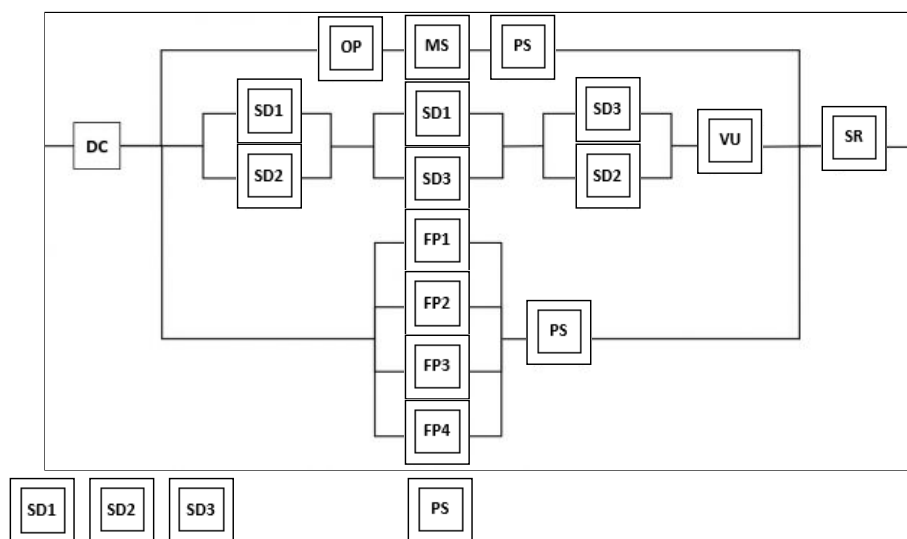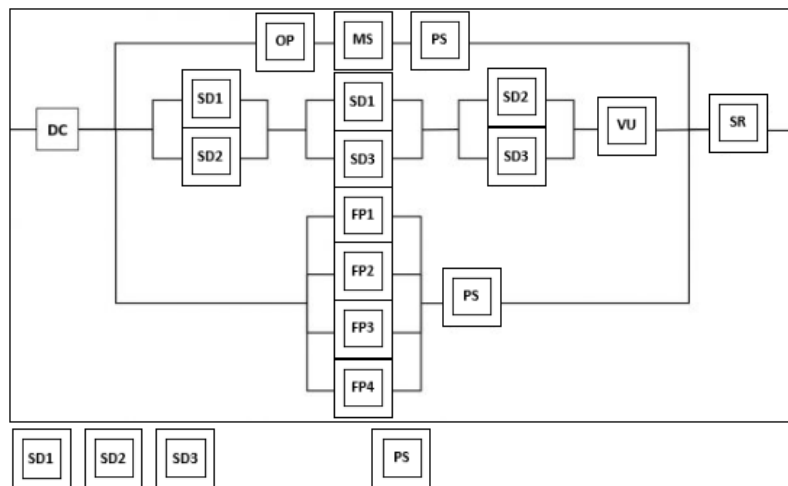
DC — SD1/SD2 — SD1/SD3 — SD2/SD3 — VU — SR

OP MS PS

FP1 FP2 FP3 FP4 PS

SD1 SD2 SD3 PS

Comment:

You are provided with the following data set of pump failures over time:

Failure Obs., i	Operating Time
5	1
14	2
24	3
29	4
27	5
24	6
22	7
20	8
19	9
16	10
17	11
18	12

What is the probability that a pump will fail at t=2, given that it survived until then?

Select one:

- a. 0.004
- b. 0.065 ✔
- c. 0.109
- d. 0.084
- e. 0.006
- f. 0.009

Your answer is correct.

The correct answer is: 0.065

Question 14

Incorrect

Mark 0.00 out of 2.00

You are provided with the following data set of pump failures over time:

Failure Obs., i	Operating Time
3	1
11	2
19	3
23	4
19	5
15	6
11	7
8	8
5	9
1	10
0	11
0	12

What is the probability that a pump will last to t=4?

Select one:

- a. 0.62
- b. 0.7 ✖
- c. 0.73
- d. 0.69
- e. 0.75
- f. 0.51

Your answer is incorrect.

The correct answer is: 0.51

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