

1- A measurable space  $(X, A)$  is a set  $X$  and a  $\sigma$ -algebra  $A$  on  $X$ . True Definition

2- if  $f$  is bounded on  $[a, b]$  & if the points of discontinuity of  $f$  on  $[a, b]$  form a null set then  $f \in L^1[a, b]$ . True Theorem

3- A series of real numbers is absolutely convergent if and only if it can be expressed as the difference of two convergent series of positive real numbers. True Theorem Proposition  
 $|a_n| = a_n^+ + a_n^-$   $\sum a_n^+$  &  $\sum a_n^-$  are convergent

4- Any countable set on the real line is null and so the rational numbers form a null set. True Theorem

5- Any step function may be expressed as a finite linear combination of characteristic function of disjoint intervals. True Theorem

6- if  $S$  is a null set on  $\mathbb{R}$  then there is an increasing sequence  $\{\psi_n\}$  of step function for which the sequence  $\{\psi_n\}$  converges and such that  $\{\psi_n(x)\}$  diverges for every  $x$  in  $S$ . False  
 Almost everywhere  $\sum \psi_n$  converge and the point fail to converge  $\{\psi_n\}$  in  $x \in S$

7- Any increasing sequence  $\{s_n\}$  of real numbers is convergent if and only if, it is bounded above. True  
 Axiom of Completeness theorem

8- A compact subset of  $\mathbb{R}^k$  has finite measure. True (Proposition) (Theorem)

9- Any countable set on the real line is null. True proposition Theorem

10- A ring is closed under taking the set operations  $\cup, \cap, \setminus$ . True Definition  $R$  let  $S, T$  be measurable sets, then so are  $S \cup T, S \cap T, S \setminus T$

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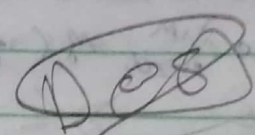
- 1- The Lebesgue integral is a linear, Positive absolute operator on the linear space  $L^1$ . True Definition
- 2- if  $f$  is monotone on  $[a, b]$  then  $f$  is integrable on  $[a, b]$ . True Theorem Corollary
- 3- All Continuous & all integrable functions are measurable. True Theorem
- 4-  $\int_E f = 0$  if and only if  $f = 0$  a.e. on  $E$ . True Theorem
- 5- If  $S$  is a measurable set and  $m(S) = 0$  if and only if  $S$  is null. False  $m(S) = 0$  iff  $S$  is a null set
- 6- Fatou's Lemma states that let  $f_n$  be a sequence of +ve measurable functions on  $E$ . if  $f_n \rightarrow f$  in Measure on  $E$ , then  $\int_E f \leq \liminf_{n \rightarrow \infty} \int_E f_n$ . True Theorem
- 7-  $\int_E f = 0$  if and only if  $f = 0$  a.e. on  $E$ . True Theorem
- 8-  $\int_E f = 0$  if and only if  $f = 0$  a.e. on  $E$ . True Theorem
- 9- By means of the Monotone Convergence theorem we can evaluate the integrals such as  $\int_{-\infty}^{\infty} e^{-|x|} dx = \lim \int f_n = 2 = \int_0^1 x^{-1/2} dx$ . True & Example in book Page 99
- 10- Assume  $A$  is a Lebesgue measurable subset of  $\mathbb{R}$  of finite measure and  $\phi(x) = |A \cap (-\infty, x]|$ . Then  $\phi$  is Continuous at each  $x \in \mathbb{R}$ . True

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1. A set function is a function whose range is a class of set  
Domain ~~could be false~~
2. Extended Real Valued Set function is a set function of  
range of Complex numbers and also could be  $\pm \infty$   
~~could be false~~
3. If  $\mu$  is a measure on a ring  $R$  a set  $E$  in  $R$  is said to have  
finite measure if  $\mu(E) \leq \infty$   
~~false~~  $\mu(E) < \infty$  
4. The measure of  $E$  is  $\sigma$ -finite if there exists a sequence  
 $\{E_n\}$  of sets in  $R$  such that  $E \subset \bigcup_{n=1}^{\infty} E_n$  &  $\mu(E_n) < \infty$ ,  
 $n = 1, 2, \dots$  True Definition
5. An extended real valued set function  $\mu$  on a class  $G$  is not  
Continuous from below at a set  $E$  (in  $G$ ) if for every increasing  
sequence  $\{E_n\}$  of sets in  $G$  for which  $\lim_{n \rightarrow \infty} E_n = E$ , we have  
 $\lim_{n \rightarrow \infty} \mu(E_n) \neq \mu(E)$  false Continuous
6. A hereditary class is  $\sigma$ -ring iff it's not closed under the  
formation of countable unions false Closed
7. An outer measure  $\mu^*$  is a set function from a hereditary  
 $\sigma$ -ring  $H$  to the positive extended real values such that (non-negative)  
(monotonic) and (Countable subadditive) false non-negative
8. Let  $\mathcal{E}$  be a  $\sigma$ -algebra over a set  $X$  and  $\mu$  be a measure on  $\mathcal{E}$ .  
Then the inner measure  $\mu_*$  induced by  $\mu$  is defined by  $\mu_*(T) = \inf_{\mathcal{E}} \mu(S)$   
 $\{ \mu(S) : S \in \mathcal{E} \text{ and } S \subset T \}$  sup false
9. If  $\mu$  is  $\sigma$ -finite measure on a ring  $R$ , then there is a unique  
Measure  $\bar{\mu}$  on the  $\sigma$ -ring  $\mathcal{S}(R)$ , such that for  $E$  in  $R$ ,  
 $\bar{\mu}(E) \neq \mu(E)$ ; the measure  $\bar{\mu}$  is  $\sigma$ -finite  $\bar{\mu}(E) = \mu(E)$  false
10. A set  $X$  is non-measurable set iff  $\mu^*(X) > \mu_*(X)$ ; which means  
inner and outer measure of  $X$  are equal false  
 $\mu^*(X) > \mu_*(X)$  or  $\mu^*(X) = \mu_*(X) = \infty$

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- 11 - A Measurable function is a function between two unmeasurable spaces such that the preimage of any measurable set is measurable. false measurable
- 12 - A sequence  $\{f_n\}$  of a finite valued measurable functions converges in measure to the measurable function  $f$ , if for every any  $\epsilon > 0$   $\lim_{n \rightarrow \infty} \mu(\{x: |f_n(x) - f(x)| \leq \epsilon\}) = 0$ . false  $\geq \epsilon$
- 13 - So long as there are non measurable sets in a measure space, there aren't non-measurable functions from that space. false are
- 14 - If  $\mu$  is a measure on a ring  $R$ , then  $\mu$  is monotone or subtractive. True Theorem monotone & ring
- 15 - Every set  $E$  in  $H(S)$  has a measurable kernel. True Theorem
- 16 - Every countable set is a Borel set of measure zero. True Theorem
- 17 - The measure of a singleton is zero. True Theorem
- 18 - Let a closed set  $F$  be a subset of a bounded closed set  $G$ . Then  $\mu(F) \leq \mu(G)$ . True Theorem
- 19 - ~~ACCA~~ Repeated
- 20 - If  $f$  is measurable and  $|f|$  is integrable, then  $f$  is integrable. True Proposition

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2- If  $(X, A, \mu)$  is a measure space and  $1 \leq p \leq \infty$  then  $L^p(X)$  is a Banach space. False  $1 \leq p < \infty$

2- ...

3- ...

4- If a +ve function has Lebesgue integral equal to zero then the function is zero a.e. True Theorem

5- The function  $f(x) = \frac{1}{1+x^2}$  has  $\sup f = \max f$  and  $\inf f = \min f$

False  $\max = \sup = 1, \min \neq \inf$

6-9

10- The function  $f: \mathbb{R}^k \rightarrow \mathbb{R}$  is measurable if the truncated function  $\min\{f, g\}$  is integrable for every positive integrable function  $g$  in  $L^1(\mathbb{R}^k)$ . True Definition Pg 120

11-12-

13- The smallest linear space containing  $L^{loc}$  is denoted by  $L^1$  which is the set of all function of the form  $f = g \cdot h$  where  $g \in L^{loc}$  and  $h \in L^1$  and so  $L^1$  is called the space of Lebesgue integrable functions. True Definition

14-15-

16- The union and intersection of a countable number of measurable sets are measurable sets. True Theorem

17- ...

18- Any ring is a semi-ring. True Theorem

19- The Lebesgue measure of  $S(MCS) = \infty$  if  $X_s$  is not integrable. True Definition Measure Pg 125

20- The rational numbers are countable set

True Theorem

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1. Let  $S, T$  be measurable sets then  $M(S \cup T) + M(S \cap T) = M(S) + M(T)$  True Theorem
2. Holder inequality let  $p, q > 1$  satisfy the relation  $\frac{1}{p} + \frac{1}{q} = 1$  if  $f \in L^p$  and  $g \in L^q$  then  $fg \in L^1$  and  $|fg| \leq \|f\|_p \|g\|_q$  True Theorem
3.  $L^1$  has the property of Completeness of the real numbers True Theorem
4. Let  $\{Q_n\}$  be a decreasing sequence of positive step functions converging a.e. to zero then  $\int Q_n \rightarrow 0$  True Theorem
5. The inner measure  $M_*(E)$  of  $E$  is the least upper bound of measure of closed sets  $F$  contained in the set  $E$ :  
 $M_*(E) = \sup \{ M(F) : F \subseteq E, F \text{ is closed} \}$  false  
 The set  $F \subseteq E$  must be closed and bdd  $\equiv$  Compact
6. If  $M$  is a measure on a  $\sigma$ -ring  $S$  of subsets of  $X$  then  $M$  is a measure on  $S$  True Theorem
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7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000-1001-1002-1003-1004-1005-1006-1007-1008-1009-1010-1011-1012-1013-1014-1015-1016-1017-1018-1019-1020-1021-1022-1023-1024-1025-1026-1027-1028-1029-1030-1031-1032-1033-1034-1035-1036-1037-1038-1039-1040-1041-1042-1043-1044-1045-1046-1047-1048-1049-1050-1051-1052-1053-1054-1055-1056-1057-1058-1059-1060-1061-1062-1063-1064-1065-1066-1067-1068-1069-1070-1071-1072-1073-1074-1075-1076-1077-1078-1079-1080-1081-1082-1083-1084-1085-1086-1087-1088-1089-1090-1091-1092-1093-1094-1095-1096-1097-1098-1099-1100-1101-1102-1103-1104-1105-1106-1107-1108-1109-1110-1111-1112-1113-1114-1115-1116-1117-1118-1119-1120-1121-1122-1123-1124-1125-1126-1127-1128-1129-1130-1131-1132-1133-1134-1135-1136-1137-1138-1139-1140-1141-1142-1143-1144-1145-1146-1147-1148-1149-1150-1151-1152-1153-1154-1155-1156-1157-1158-1159-1160-1161-1162-1163-1164-1165-1166-1167-1168-1169-1170-1171-1172-1173-1174-1175-1176-1177-1178-1179-1180-1181-1182-1183-1184-1185-1186-1187-1188-1189-1190-1191-1192-1193-1194-1195-1196-1197-1198-1199-1200-1201-1202-1203-1204-1205-1206-1207-1208-1209-1210-1211-1212-1213-1214-1215-1216-1217-1218-1219-1220-1221-1222-1223-1224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Q1

~~May~~ May 2017

- 1-d 2-d 3-a 4-c 5-d  
6-d 7-d 8-a 9-d 10-

Q3 Repeated

May 2016

1-  $L^{\text{inc}}$  denotes the set of all function  $f$  where  $f$  is the limit almost every where of an increasing sequence of step function whose integrals are bounded.

True Definition

2- The Monotone function  $f$  is continuous at the point  $P$  if and only if,  $f(P-0) = f(P+0)$ . True Theorem

3-  $M^*(E_1) - M^*(E_2) \leq 2M^*(E_1 \Delta E_2) + 2M^*(E_1 \cap E_2)$ , where  $M^*$  is the Lebesgue outer measure on  $\mathbb{R}$  &  $E_1, E_2 \subset \mathbb{R}$

True

4- ✓

5- ✓

6- The symmetric difference of 2 sets is  $A \Delta B = (A/B) \cup (B/A)$

True

7-8-9-10- ✓

Skip must prove 2 lip's  
جوابك لا بد أن تثبت 2 لپس

Mustafa Abdelkarem  
Deshay

4/6/2022



May 2015

1- let  $A \subset \mathbb{R}$  be a Lebesgue measurable set if  $0 \leq b \leq m(A)$   
 then there is a Lebesgue measurable set  $B \subset A$  with  $m(B) = b$

True

2- ✓

3- if  $|A \cap I| \leq b|I|$  for all open intervals  $I \subset \mathbb{R}$  &  $b < 1$ , then  
 $|A| = 0$  من حاله صح

4- if  $a|I| \leq |A \cap I|$  for all open intervals  $I \subset \mathbb{R}$  &  $a > 0$   
 then  $|A| = \infty$  من حاله صح

5- ✓

6- A measurable map  $T: X \rightarrow X$  on a measure space  $(X, \mathcal{A}, \mu)$   
 is said to be measure preserving if  $\mu(T^{-1}(A)) = \mu(A)$ .

True

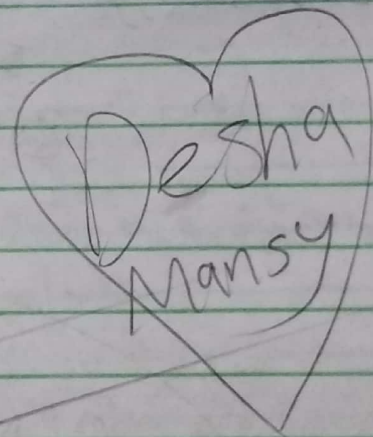
7- ✓

8- All closed sets in  $\mathbb{R}^k$  are measurable True Theorem

9- ✓

10- ✓

Mostafa Abdelkayem


 Desha  
Mansy

الى اللقاء يا بهرجين

انشاء الله خير نصيب For F

قولوا لا اله الا الله  
 فتنسلوا يا كاريها



May 2021

\*  
1. The Axiom of Completeness assures that  $\left\{\left(1 + \frac{1}{n}\right)^n\right\}$  converges to a real number between 2 and 3

True Theorem

13. Let  $\{f_n\}$  be an increasing sequence of function in  $L^{\infty}$  where integrals are bounded. Then  $\{f_n\}$  converges almost everywhere to a function  $f$ , where  $f$  lies in  $L^{\infty}$  and  $\int f = \lim \int f_n$ .

True Theorem

15. Let  $f: \mathbb{R}^k \rightarrow \mathbb{R}$  be the limit almost everywhere of a sequence of integrable function and suppose that  $|f| \leq g$  for positive integrable function  $g$ . Then  $f$  is integrable.

True Theorem

16. The product of two integrable function may not be integrable while the product of any two measurable function is measurable

True Theorem

19. If  $f_n \rightarrow f$  almost everywhere and  $f_n$  is measurable for  $n = 1, 2, \dots$  then  $f$  is measurable

True Theorem

17. All continuous and all integrable function are measurable

True Theorem

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