End Semester Examination: Summer Term

PHI455: Philosophical Logic

HSS, IIT Kanpur

General Instructions: Read carefully each question. Fill in your with a pen and circle the correct answer on paper as well. All your work must be done in these pages.

- You have up to 180 minutes.
- For each Wrong answer 0.25% marks will be deducted.
- Please ensure that you keep a copy of your rough work and save it somewhere for future reference. Save it with the course number and and your roll number.
- Every item on the test awards 2 points for each correct answer, for a maximum possible score of 60 points.
- Multiple choice questions may have more than one answer. Circle each of the correct answer.
- Each Question in part-B consists of 5 marks each. For each wrong answer(0.25%) 1.25 M will be deducted.

SIDE A

Part I. True or False Questions. 40M

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1. *Disjunctive syllogism*- the argument from $\phi \vee \psi$ and $\neg\phi$ to Ψ- is invalid in LP but valid in $K3$

   A. True B. False

2. An example of a classical tautology containing a conditional that is not a quasi-tautology in L_3 is $\neg\,(A \rightarrow \neg A) \vee \neg\,(\neg A \rightarrow A)$.

   A. True B. False

3. The following argument is valid in $C+$: If Kangaroos had no tails, they would topple over. Therefore, If kangaroos had no tails but used clutches, they would topple over.

   A. True B. False

4. The following Well Formed Formula is valid in conditional logic C: $\phi \wedge \psi \models_{C1} (\phi > \psi)$

   A. True B. False

5. The following argument is valid in Epistemic Logic (LK5=KTD4=S5): I know that apple is red implies that I think that apple is red is true. LK5 means Logic of knowledge.

   A. True B. False

6. The following argument is valid in LK5(S5): I know that I have two hands I know that, if I have two hands, I am not a brain in a vat. Therefore, I know that I am not a brain in a vat.

   A. True B. False

7. In Luckasewicz three valued Logic, $(\neg p \rightarrow \neg q) \rightarrow \neg(p \rightarrow q)$ takes the value 1/2 when both constituents takes value 1/2.

   A. True B. False

8. If the agent i knows that *if there is a smoke on the hill then there is a fire* and also he knows that *there is a fire on the hill*, then by *logical omniscience*, he is said to know that there is smoke on the hill.

   A. True B. False

9. According to Robert Stalnaker (C2), when the antecedent of the conditional is atleast possible, there is always a *unique* world at which the antecedent is true and which is more like the actual world than the is any world at which the antecedent is true. A. True

   B. False

10. The following argument is valid in conditional logic (C):*If this match were struck, it would light. If this match were soaked in water overnight and this match were struck, it would light.*

    A. True B. False

11. If most of the group knows ϕ, then the following holds: $C_G\phi \leftrightarrow (\phi \wedge E_G\, C_G\phi)$.

    A. True B. False

12. An instance of paradox of material implication, i.e., $p \rightarrow (q \rightarrow p)$, does not hold in Luckasewicz's three valued logic (L_3^s)

    A. True B. False

13. Necessity of some thing is determined in terms of conditional as follows: $\Box A =_{\text{Definition}}= \neg(A > \neg A)$, where $\Box$ represents necessity, $>$ represents conditional connective.

    A. True B. False

14. We will say that a formula is a *quasi tautology* if it is never false. Based on this definition, $(A \wedge \neg A) \rightarrow B$ is a quasi tautology in `LP` Logic.

15. The following conditional is considered to be vacuously true according to Stalnaker's conditional logic(C2): If 2+2 =5 then Shri Narendra Modiji is a pope.

16. The operator *everyone knows* ϕ , denoted $E\,\phi$, is defined as follows: $EA\,\phi{:}\ \ = \bigvee_{i \in A}^{n} K_i\,\phi$

    A. True B. False

17. The following $(p \vee q) > r \models (p > r) \wedge (q > r)$, fail in C, but hold provided we add the condition on f as indicated: $fp(w) \cup fq(w) \subset f_{p \vee q}(w)$

    A. True B. False

18. from $\phi \rightarrow E(\neg\psi \wedge \phi)$ we can infer $\phi \rightarrow C\,\neg\psi$

    A. True B. False

19. The following argument is valid in $LK5$. *1. If I know that Narendra Modi is the prime minister of India, then I think Narendra Modi is an Indian citizen. 2. I think that Narendra Modi is an Indian citizen. So, 3. I know that Narendra Modi is an Indian citizen.*

    A. True B. False

20. The following conditional is valid in $C+$: If Shakespeare was a physicist, then he was a scientist. Shakespeare was not a scientist. So, Shakespeare was not a physicist.

    A. True B. False

Part II. Multiple Choice Questions- 40M

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1. Which of the following are instances of paradoxes of Strict implication:

    1. $\Box B \models \Box(A \rightarrow B)$
    2. $\Box A \models \Box(A \rightarrow \neg B)$
    3. $\Box \neg A \models \Box (A \rightarrow B)$
    4. $\neg A \models \Box (A \rightarrow B)$

    A. 2

    B. 4

    C. 1,3

    D. None of the above

    E. All.

2. If pointless suffering occurs, then God is not both benevolent and omnipotent. But God is both omnipotent and benevolent. So, pointless suffering doesn't occur. (P: Pointless suffering occurs; B: God is benevolent; O: God is omnipotent)

    A. C

    B. C+

    C. S

    D. None of the above

    E. All.

3. $A \vee \neg A$ is a quasi-tautology in

    A. L3

    B. K3

    C. $B3^I$

    D. LP

    E. None of the above

    F. All.

4. The following argument is valid in $KTD5$ (S5): I know that Either God cannot prevent some suffering or God does not want to prevent any of it. I know that If God cannot prevent some suffering, then God is weak. I also know If God does not want to prevent any suffering, then God is not good. So, I know that either God is weak or God is not good. Note that here the scope of knowledge operator is over the whole disjunction and the conditional.

    A. Valid

    B. Invalid

    C. cannot be determined

    D. None of the above

5. If humans do not have free will, then they are not responsible for their actions. But obviously, humans are responsible for their actions. Thus, humans have free will. (F: Humans have free will; R: Humans are responsible for their actions)

    A. L3

    B. K3

    C. LP

D. RM3

E. None of the above

F. All

6. Which of the following formulas are tautologies in K_3 (note that they are all classical tautologies):

   1. $\neg P \rightarrow (P \rightarrow Q)$
   2. $(P \rightarrow \neg P) \rightarrow \neg P$
   3. $(P \leftrightarrow Q) \vee (P \leftrightarrow \neg Q)$
   4. $(P \wedge Q) \rightarrow (P \vee Q)$

   A. A

   B. B

   C. A, B, C, D

   D. None of the above

   E. All

7. The following argument *I know that If it is raining, then the ground is wet. I also know that the ground is wet. This implies that I dont know that it is not raining* is

   A. Valid

   B. Invalid

   C. None of the above

8. Which of the following arguments are valid in $C1$:

   1. $(A > B) \wedge (B > C) \models (A > C)$
   2. $(A > B) \vee (A > \neg B)$
   3. $(A \wedge B) \vdash A > B$
   4. $(A > B) \models (\neg B \ \neg A)$
   5. $(A \vee B) > C \models (A > C) \vee (B \rightarrow C)$

   A. A, B

   B. C, D

   C. All

   D. None of the above

Part III. Rough Work

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Part I11. Rough Work